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IDEAS  
20 PAGES**

# Popular Mechanics

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six months** Page 160

**World's first  
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- How to fix a gas clothes dryer
- How to pick the right paint roller
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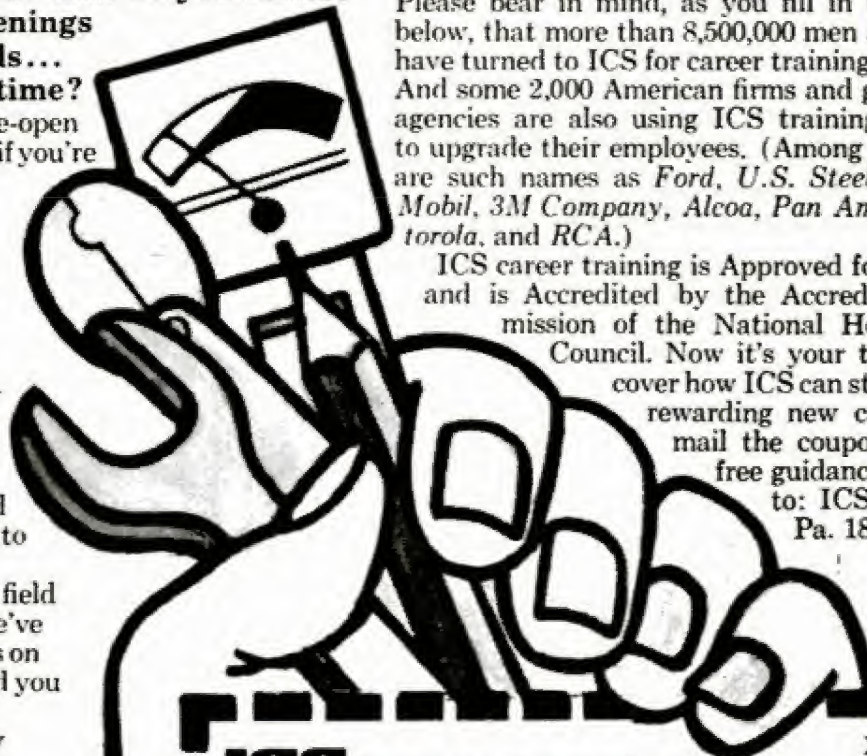
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# Popular Mechanics

DECEMBER 1973 • Vol. 140 No. 6

### INTERNATIONAL EDITIONS

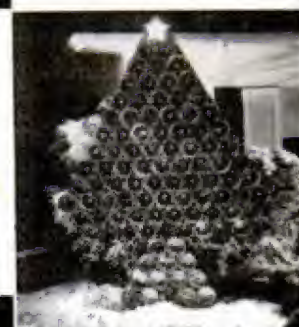
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ON THE COVER: The Scamp, Designer Harris "Woody" Woods' new VW-powered, all-metal low-cost biplane. You can build it from PM plans. Photo: Howard Levy

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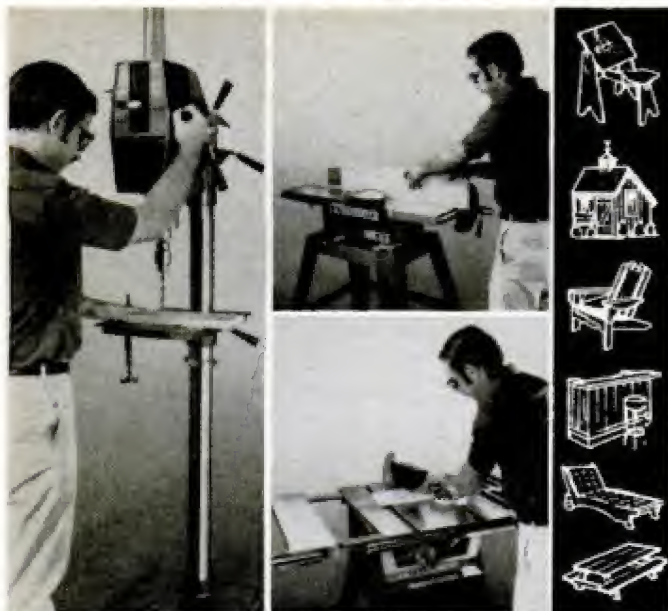
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Turn on "The Wacky World of Jonathan Winters" on local television.

## LETTERS

### TO THE EDITOR

#### More fun to drive old cars

I enjoyed the three viewpoints on beating the new-car game (*Should You . . . Trade In? Hang On? Cop Out?* page 124, Oct. PM). I, too, own a Volvo 145, a 1970, and we love it dearly. And the '52 Hudson owner can't be righter in my opinion.

My second car has been a series of no-depreciation, *interesting* cars; a 1936 Ford pickup with '59 Olds engine (bought it for \$400, sold it for \$500); a 1929 Chev coupe (bought it in a basket for \$400, sold it for \$500 when I admitted I never had time to restore it); a 1965 Sunbeam Alpine for which I bought a parts car and scrounged a good engine, hardtop, etc.; and now a 1960 Austin Mini-Cooper, which is a hell of a lot of fun to drive, beats new Detroit monsters and gets 35 miles to the gallon. I don't think I'll ever buy a new car—no fun.

LOS ALTOS, CALIF.

STEVE FRY

I couldn't have been more delighted with Michael Lamm's article about his 1952 Hudson.

I have *not* had to scrounge for parts or even do more than normal upkeep and repairs on my '55 Buick (which also had 76,000 miles at purchase).

I think that many consumers simply cut down on the normal care they give new cars as they grow older (or if they buy an older car cheaply). Their mistake is in valuing the car by its current market value. So Mr. Average Guy says, "Why should I pay more for repairs or new tires than the car is worth?"

My \$150 Buick is better than a new car with problems. So am I foolish to buy a good battery or wide radial tires? Or to service it as regularly as a new car?

PACIFIC PALISADES, CALIF.

ROGER VIVIAN

#### Waiting for answer paid off

You answered my question about an "Un-agitated Agitator" on a Maytag washer in the September *Appliance Clinic* (see page

[\(Please turn to page 10\)](#)



# TOM McCAHILL SAYS:

**"You can pocket \$5 to \$7 an hour if you're good enough to fix these things."**

The coming of the automobile built a multimillion dollar service industry in a few, short gas-eating years. The same thing has happened in the electrical appliance field. Manpower is desperately needed now to repair appliances.

But there is one big difference. Anybody with a few simple tools can get started in appliance repair. No expensive equipment is needed.

What is needed is the right kind of training. You can't strike it rich in today's job market with nothing more than muscle. Nor can you hang onto an old-time job skill while an electronic monster with buttons replaces men around you. It's like driving a buckboard down the Jersey Turnpike. The fuzz would locate you fast and send you out to pasture.

If you want an up-to-date job skill with good opportunity—why not take a look at the Electrical Appliance Repair field?

This field is loaded with opportunity because every house in our high speed land is loaded with appliances. There are about four times as many appliances as we have men, women, children and babies in the good old U.S.A. There are over a billion of these electrical gadgets being used, abused and broken. If you know how to do fast repair jobs on them, how much you can earn can well depend on how much you want to earn.

The opportunities in this field are all the better because you can prepare for them fast. There's one short, sweet course you can take right in your own home and it covers everything. I'm referring to a home-training course offered by the Appliance Division of National Radio Institute—one of the biggest and oldest home study schools of its kind.

NRI gives you the whole works. Their training covers basic electricity and how to use test instruments. They cover the electrical and mechanical operation of every type of appliance from toasters and coffee-makers to dishwashers; from vacuum cleaners and automatic laundry equipment to air conditioners and refrigerators. They even show you how to fix farm and commercial appliances and small one-lung engines.

The training is designed to be interesting, practical and fast. You can make \$5 to \$7 an hour extra fixing



appliances in spare time starting soon after you enroll. They give you all you need to know to do fast, profitable repair service. They even include equipment without charging you extra. And the full cost of the training is surprisingly low.

If you are driving a buckboard in today's job market, at least find out what the Appliance field can do for you. NRI sends you a fancy, illustrated book about their training so you can judge for yourself. There's no obligation and they don't send a salesman to pressure you. All I say is get the facts and see for yourself. Send the coupon today while you are thinking about it.

*Tom McCahill*

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## LETTERS

(Continued from page 8)

62). Things turned out just as author Paul Mann said: It was the nylon rollers.

I got the parts for \$3 and one hour later I had the job done. While I was at it, I asked the appliance repair company how much it would cost to have them installed; it would have been about \$22. So waiting for my answer in *PM* paid off—almost \$20 worth.

Thank you for the detail and space you used to answer my question.

WATERBURY, CONN.

ALBERT DALTON

### Good guess, says Gillespie

It is easy to see what type of shotgun author Gary Gillespie grew up with (*How to Select a Modern Scattergun*, page 134, Sept. *PM*). It was most probably a pump shotgun, but clearly a 12-gauge.

I grew up shooting a 20-gauge double-barrel. I have used my 20-gauge for all types of upland game and waterfowl, including pass shooting with good success.

My selection for a "best buy" is an American 20-gauge double-barrel, chambered for three-inch shells with barrels choked, improved cylinder and modified.  
SUNBURG, MINN. ROGER L. JONES

*Author Gillespie says that you made a good guess—and he still has the gun. As for your choice of a best buy, he won't argue with it.*

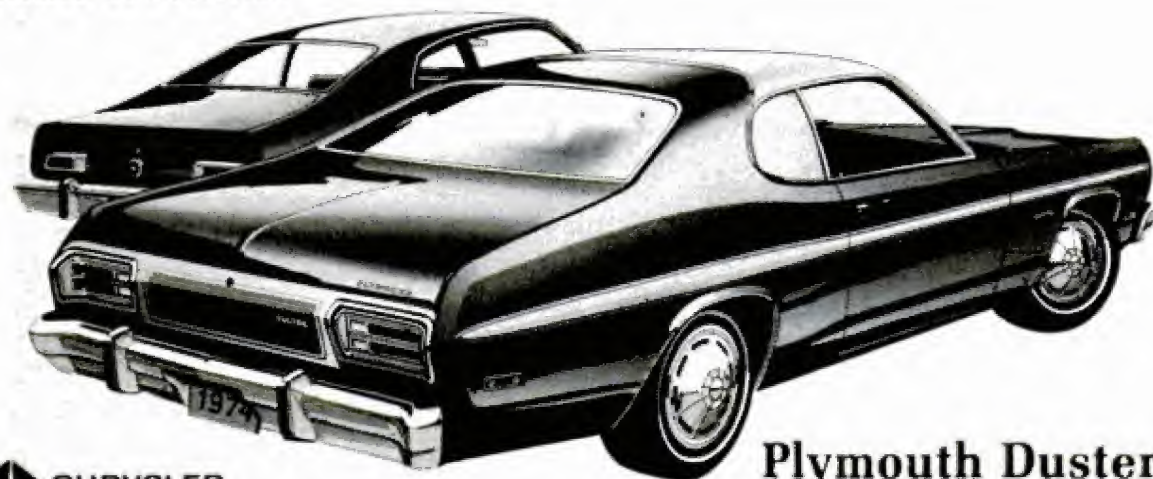
### Easy fix for a water heater

As a property owner, I appreciated your article, *How to Troubleshoot a Water Heater* (page 84, Sept. *PM*). However, I feel you have not mentioned a problem that is fairly common and relatively easy to solve. Many times the dip or drop tube itself becomes deteriorated to the point that the incoming cold water does not reach the bottom of the tank, and a shortage of hot water then exists.

The correct way to fix it is to disconnect the cold-water line, remove the old dip tube and insert a new one. This assures that cold

(Please turn to page 13)

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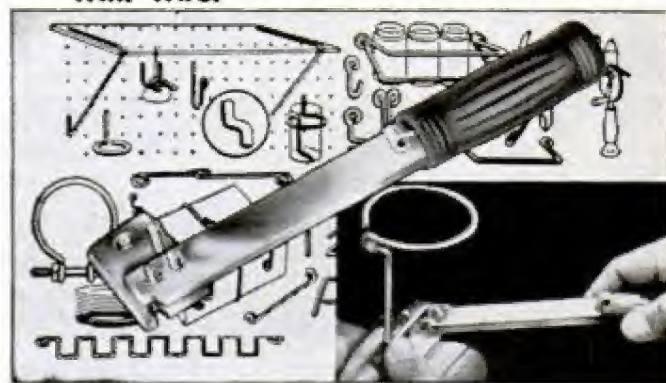
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## LETTERS

(Continued from page 10)

water will reach the bottom of the tank instead of neutralizing the hot water at the top of the tank.

WICHITA, KANS.

KEVIN KIMMEL

### Needs help on the hills

Reading your articles on bicycles in recent issues gives me an idea. Why not make a bike motor for aiding in climbing hills? The main reason I can't ride a bike to work is up-and-down hills. If a battery-powered electric unit could be mounted on the front wheel to pull up the hills, I could easily pedal across the flats.

OCEANSIDE, CALIF.

DUWAYNE A. PHILO

*We've received a couple of news releases recently describing power units for bicycles, though we've never tried one so we don't know how well they work. One Chicago firm offers plans for three different electric-motor setups. For information, contact Sheldon Shacket, The Flying Zeemo Electric*

*Bicycle Co. of America, 2239 North Lincoln Ave., Chicago, Ill. 60614.*

*There's also a new gasoline-powered auxiliary motor called "Chicken Power." It weighs only seven pounds and "adds the power of one full horse (or an estimated 650 chickens) to a bicycle." You can get information from O & R Engines, Inc., 3340 Emery St., Los Angeles, Calif. 90023.*

### Small projects? We still have 'em

I realize that the majority of your readers are experienced craftsmen, but there are a lot of us who don't have the money or tools required for most of your projects. For example, your dry sink (*Little Colonial Charmer*, page 138, Feb '72 PM) and *An Early American Hutch-Table* (page 96, July '73 PM). You have published a few small projects before, but you seem to have quit. I would appreciate it if you would start publishing such articles again.

FULTONDALE, ALA.

PAUL DOWNS

*We really haven't quit. You must have*

*(Please turn to page 14)*

**There are a lot of big reasons for buying a Duster instead of a Pinto.**

**Duster has room for five. Pinto has room for four.**

**Duster's trunk is almost three times bigger than Pinto's.**

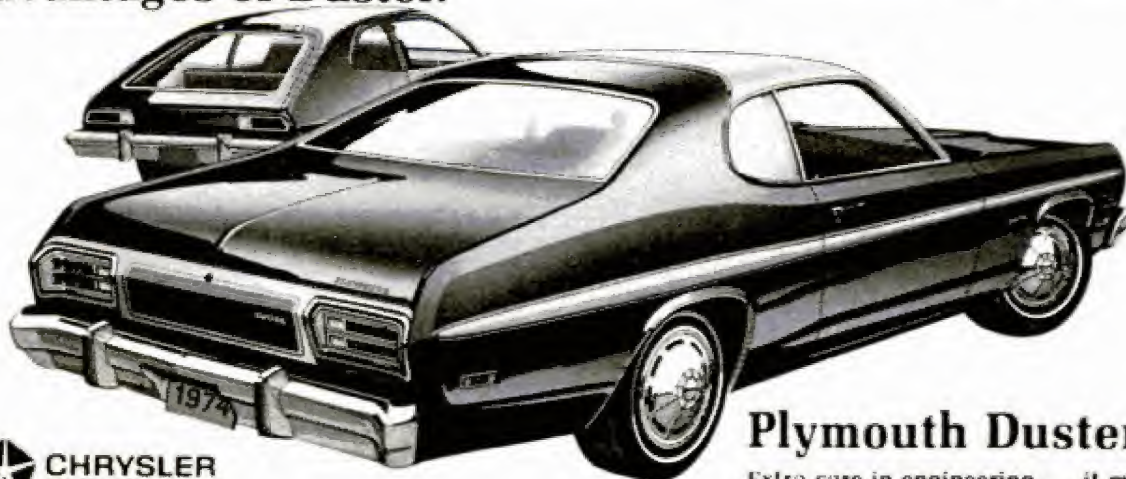
**Duster's engine offers half again as much horsepower.**

**And Duster has a wider stance.**

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**So there's little reason to buy a Pinto when you know the big advantages of Duster.**



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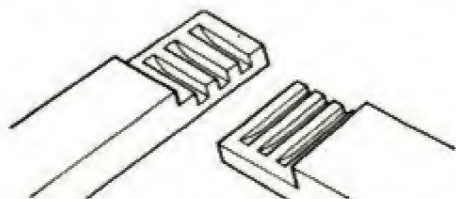
## LETTERS

(Continued from page 13)

liked the 21 pages of Christmas Gifts You Can Make in the November issue (page 89) and you'll also find more small projects on page 150 of this issue.

### Stop short for better joint

In a May 1973 *Hints From Readers* page, the item "Joint-Gluing Trick" (page 161) suggested that shallow saw kerfs be cut in the lap faces for better gluing of a half-lapped joint. The problem is that if the frame is exposed, the kerf holes must be



filled and sanded. This could be eliminated by stopping the kerf grooves short of breaking through, as shown in the drawing. I think the original idea is great, but this suggestion would save a little work later.  
WARREN, MICH. JOHN C. MEISSNER JR.

### Still doesn't believe it

Thanks to you, I am not afraid of my circular power saw any more. *Benchtop Saw Table Converts Portable to 'Radial'* (page 170, Sept. PM) has got to be one of the best articles PM ever did.

I work it, but I still don't believe it. This saw table does it all—and if it's any news to the people who introduced this wonder, you can adapt a router and jigsaw with very little effort using the right accessories. Instead of moving the tool, you move the work; it's that simple.

LOS ANGELES

HERMAN MARTIN

### Sand for a whetstone

In the October *Homeowners' Clinic* (page 82), Leroy Hoadley asks about "trueing up" a whetstone or oilstone.

For the home-workshop mechanic, the practical and safe way to resurface or "joint" an oilstone is to use very fine sifted sand on a level base of concrete (such as a cellar floor).

Rub the stone about on this fine sand, preferably in a figure eight. As the sand breaks down, use the finest of this to finish the job. It is safe and easy and if carefully done will give perfect results.

BURLINGTON, VT.

L. C. BEAUREGARD

### PM Christmas-display builders

My Christmas yard display (*Build PM's 'Sequence Santa' Electric Greeting Card*, page 172, Nov. '70 PM) was an enjoyable and satisfactory project. One problem I had was that the lights did not go off



simultaneously. I corrected it by changing the wiring so the first switch became the on-off switch for all other switches.

WATERBURY, CONN.

HANK RONCARTI



My Santa (*Hi, There!* page 109, Nov. '72 PM) turned out very well. My special thanks to PM for a good Christmas display for my porch.

NEW CARROLLTON, MD.

PETER KUCYK

I made the Santa Claus with the moving arm and put it up on my lawn. It turned out great, and I got many comments.

BROOKFIELD, WIS.

RONNIE DERRWALDT

Photocopies of the original articles can be ordered for 20 cents per page plus 25 cents postage from Popular Mechanics, Dept. JL, Box 1014, Radio City, N. Y. 10019. ★★★



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## HINTS

### FROM READERS



#### Holding odd diameters in lathe collets

Lathe collets will hold between-size diameters if you use simple bushings made from sheet-metal strips of uniform thickness. Each strip is rolled into a tube that fits over the workpiece, with a small gap between strip ends; position the gap near or in line with one of the collet's slots. If necessary, two thicknesses can be used, or the bushing can be machined from tube or bar stock.

—B. W. Erwin, Kent, Ohio



#### Tires make Christmas-tree base

I found that rim-mounted tires (off car while snows are used) and a piece of plywood bolted to the rims made a solid base for a small Christmas tree. Bring wiring through center before base is draped.

—Stanley R. Pennington, Fairview, N.J.

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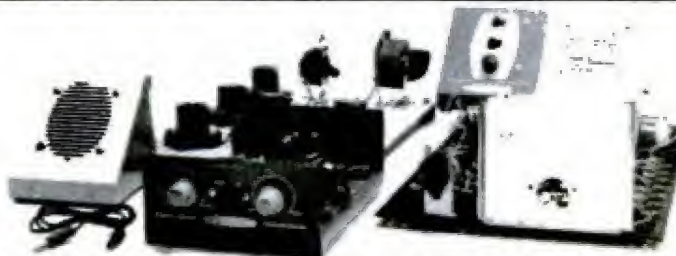
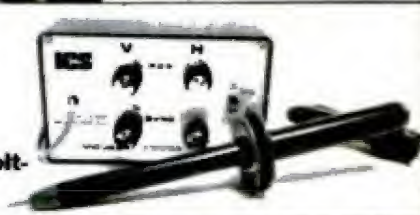


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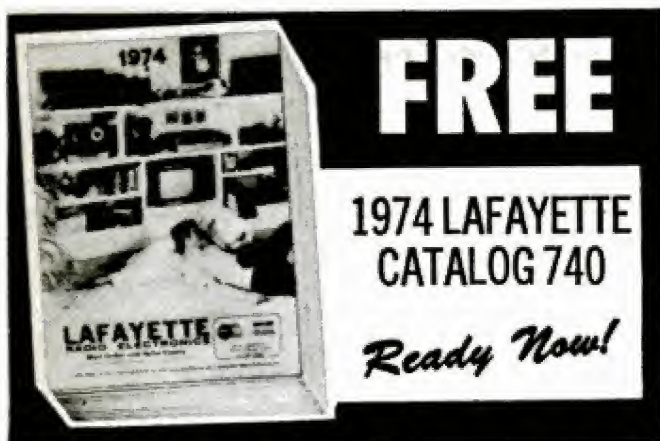
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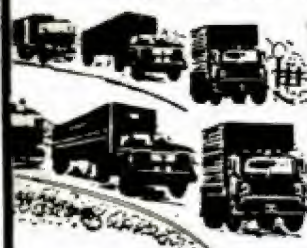
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BY PAUL MANN

## APPLIANCE CLINIC

### Won't hold water

*The problem with our Maytag automatic clothes washer, model A-702, is that during the wash-rinse cycle, water drains out of the tub. The unit doesn't fill. The only way to get water into the tub is to advance the timer to SPIN DRY and recycle to the beginning. Help!—R. Wong, Concord, Calif.*

The cause of your problem is probably that the end of the unit's drain hose is below the level of the water in the tub, creating a siphon effect. It is the same as siphoning a fuel tank by dropping a hose below the level of the fuel. The drain hose of an automatic washer should terminate at a point that is above the tub water line, or at least level with it. This may not be possible in some installations. For this reason, some automatic washers have an anti-siphon device built into them that interrupts the flow of air which creates the siphoning action. If you can't raise the end of the drain hose, you should install an antisiphon device. Maytag makes one, part No. 2-1112. Get it from a Maytag dealer.

### Sticks fix

*Because our summer home is in the "sticks," I can't get a refrigerator serviceman to come and fix a Hotpoint refrigerator, model EB 87, which was manufactured in 1954. The only problem I have with this excellent unit is that it won't go back to REFRIGERATE after it has been on AUTOMATIC DEFROST unless I jump the circuit. What do you suggest I do?—Daniel Cody, Union, N.J.*

I suggest that you contact the right people at the right place. They will see to it that an authorized serviceman is made available. If there were just one component that could cause this problem, I would outline the way to fix it and the services of a technician would be unnecessary. But there are several possible reasons for this condition, and indiscriminate replacement of parts could cost you a good deal of money for nothing. For

(Please turn to page 24)



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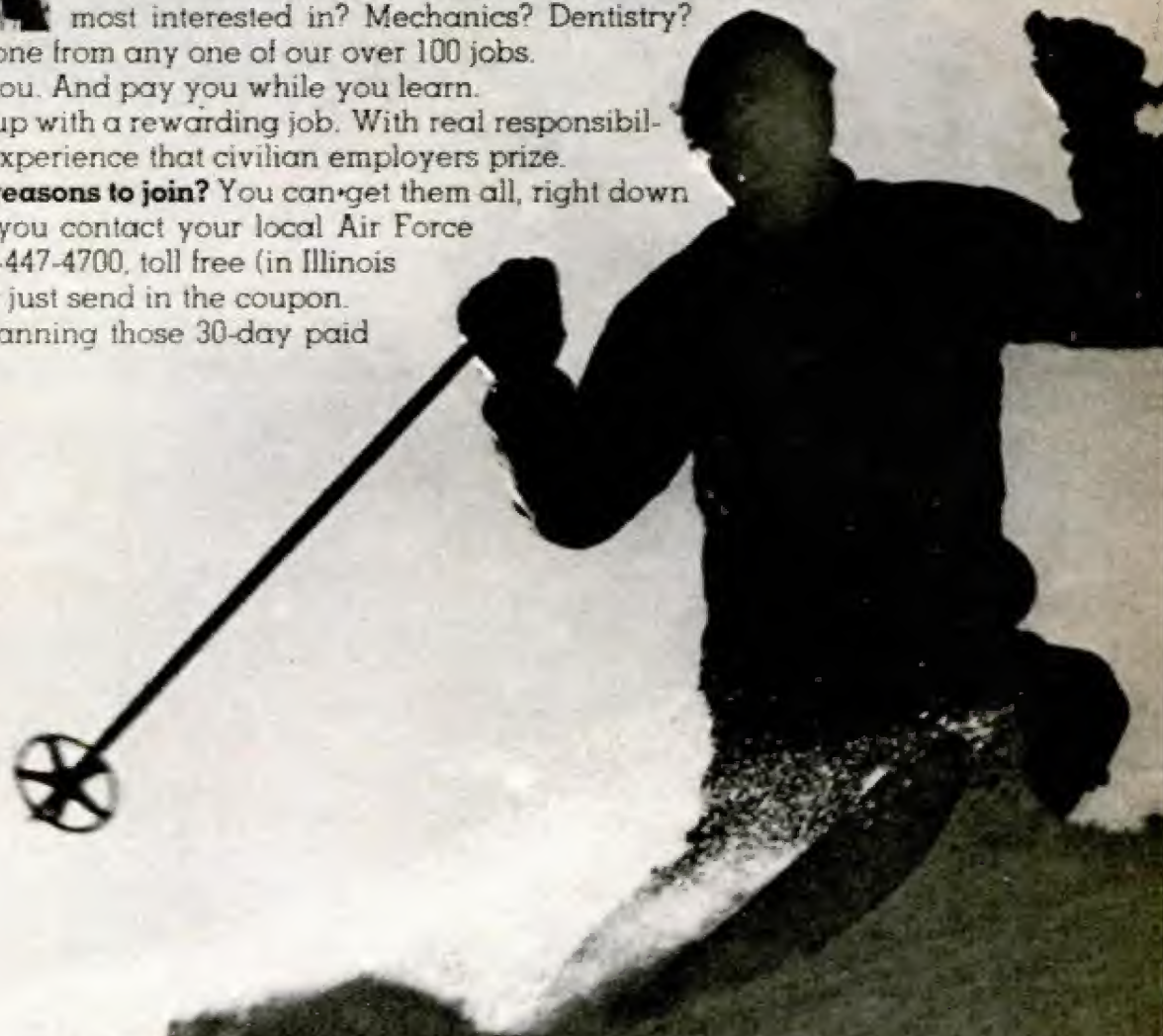

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### APPLIANCE CLINIC

*(Continued from page 22)*

example, the trouble could be caused by a bad defrost timer that allows the refrigerator to kick into defrost but doesn't let it kick out of defrost automatically. Or the cause could be a weak heater that is taking several hours to defrost the refrigerator, when defrost should take only about 10 to 15 minutes.

Hotpoint reports it has authorized servicemen going to any location where there is a Hotpoint appliance. I suggest that you get in touch with the field service supervisor at the technical service department of Hotpoint in North Caldwell, N.J. The telephone number is (201) 256-8770.

### Water gate

*Water keeps running into my GE dishwasher even when the unit is not being operated. The only way to halt the flow is to close off the valve on the water line. What's wrong?—Felix F. Gines, Alhambra, Calif.*

There is something wrong with either the

machine's water valve or its timer. If the unit is an under-the-counter model, take off the bottom control panel. If the unit is a portable model, remove the front panel. This reveals the water valve. Remove the wires from the valve, disconnecting it from the timer. If water now flows into the dishwasher, the unit has a bad valve. If no water flows, the timer should be replaced.

### Not seeing red

*Our Tappan electric stove is 13 years old. Because its four surface units wouldn't turn red when on HIGH, I jumped the gun and purchased four new units. They don't get red hot either. Why?—E. J. Bussey, Hartford, Conn.*

There are several possible reasons. The first thing you should do is push each unit completely home to make sure it's firmly in its socket. If this doesn't make you see red, find the terminal block at the rear of the range. A voltmeter reading at this block should be 230 v. If it is not, then the terminal block may be burned (look for blackness) and will have to be replaced. Damaged wires



are another possible cause of the problem. Shut off power, remove the front panel and examine wiring. If it is broken, the range will have to be rewired. Since few servicemen do this, you should then contact Frank Stevens, Technical Service, Tappan, 101 Kuller Rd., Clifton, N.J. 07015—telephone (201) 881-7966.

### Noisy disposer

*We recently purchased a GE food waste disposer which works fine, except that it is very noisy. I investigated by turning off the switches and putting my hand inside the unit. One of the spinners is so loose that I can lift it up. The other spinner can't be lifted, although it does spin around. Is this a normal situation?—Mrs. Stanley Nosko, Manchester, Mass.*

Both spinners (impellers) should be held fast to the flywheel, although both should revolve. The job of the impellers is to throw waste against the shredding ring. Impellers are usually riveted to the flywheel. (In some disposer models, they are held by bolts and nuts).

If a rivet has failed, the flywheel should be replaced. I would get in touch with the dealer or with a GE service center. If the unit is still under warranty, the repair should be free.

### Open and shut case

*Our Westinghouse refrigerator-freezer frequently doesn't turn itself off when it should. If we turn it off manually and immediately turn it back on, it will remain off until it's supposed to go back on again. We thought the problem was a faulty control, so we had that replaced, but the trouble continues. Can you suggest a cure?—E. F. Dailey, Freeport, Fla.*

If the trouble isn't being caused by a bad thermostat, then chances are it's a faulty control relay on the motor that should be replaced. ★★★

*If you have a question about any appliance, send it to Appliance Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. Sorry, but letters cannot be answered individually. Problems of wide interest will be answered in this column.*

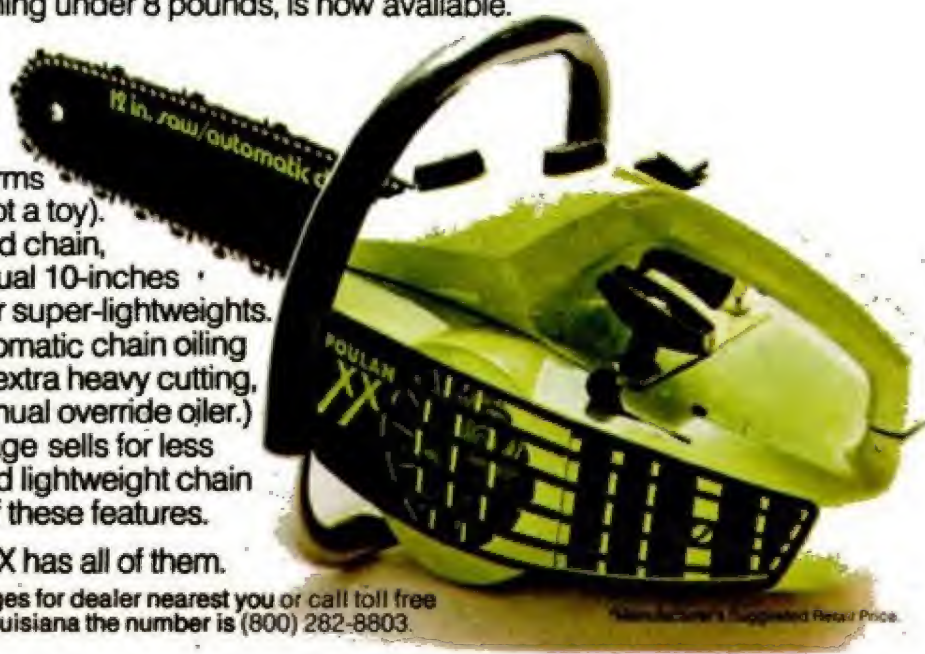
## Next year's hottest selling super-lightweight: The new Poulan XX. \$99<sup>88\*</sup>

Introducing another sure winner. The brand new Poulan XX, weighing under 8 pounds, is now available.

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## DETROIT LISTENING POST

### GM orders: Make 'em small

Five new cars from GM! All mid-sizers or minis. The mid-sizers will be within an inch or two of GM's current X-body cars: Chevrolet Nova, Pontiac Ventura, Oldsmobile Omega and Buick Apollo. The minis will be smaller than today's Vega. When? As soon as GM can rev up to produce them. The Cadillac and Pontiac cars will be out a year from now—next fall or as mid-year introductions in the spring of 1975. The Buicks, Olds and Chevys will follow a year later.

GM has reluctantly confirmed smaller cars are coming from Cadillac and Pontiac. Reluctantly because there's a rule at GM that you don't take the shine off this year's cars by talking about what you plan to bring out next year or the year after. But the general managers of all five GM car divisions have said, either at press conferences or in private conversations I've had with them, that small is the only way to go "and we intend to compete in that market."

### Overdrive for Vega Wankel

Standard or as an option, one way or the other, overdrive will be used on the Wankel-powered Vega coming from Chevrolet next

year. But GM won't call it overdrive. It'll be known as the "fifth gear" and there will be an extra slot on the gearshift. GM's been running comparison tests of Wankel engine cars with and without the fifth gear and has achieved fuel economy results with overdrive equal to or surpassing mpg with piston engine cars.

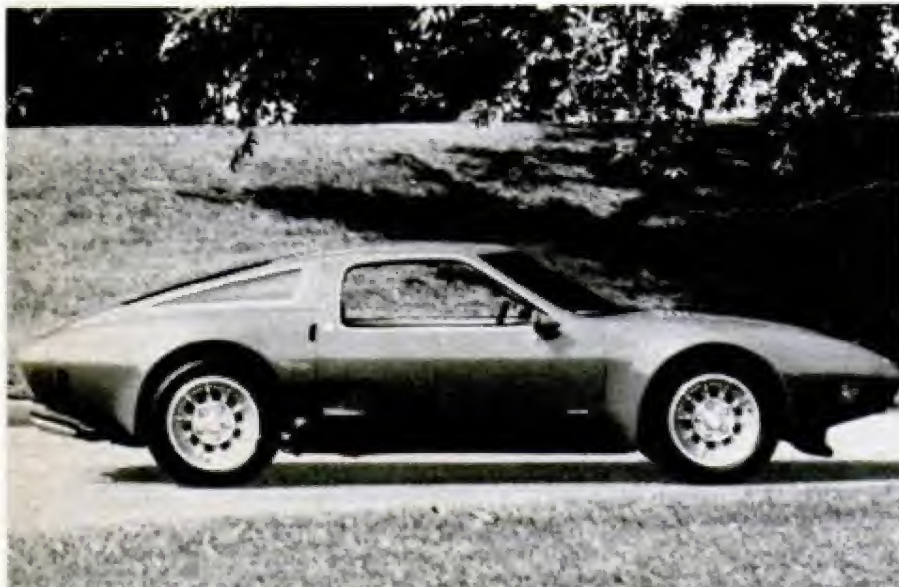
### Chapter II on Mustang II

Part of Ford's pitch for Mustang II is that it was time to come up with a new car because the original Mustang had become too big, overblown and expensive. But Ford doesn't add that Mustang II was launched on the same course of bigger and better before the first II came off the line. The car will stay the same size for the next few years, but it will obviously cost more when V8 engine and performance driveline are added next year.

### Pontiac pedals to proliferate

Pontiac isn't going to have an exclusive on its adjustable foot pedals very long. (The brake and accelerator pedal can be moved

*(Please turn to page 32)*



**From Detroit with style.** The long-anticipated mid-engine Corvette has arrived—not with trumpets and fanfare, but with utmost secrecy: It was whisked off to the European auto shows before we could do anything more than get a quick picture. This is the Corvette Two Rotor. It's only one of at least two models that'll be used to test public reaction before one of them becomes the '75? '76? production model. In the Two Rotor, the GMRE (General Motors Rotary Engine) mounts transversely ahead of the rear axle. It displaces 4.4 liters and is coupled with a three-speed automatic transmission. This hatchback is shorter and lower than the current Corvette, yet has better space utilization. Styling was done at the GM Tech Center; body is metal.



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## DETROIT LISTENING POST

(Continued from page 30)

up or down, depending on how tall you are.) Other GM divisions are already lined up to pinch the idea next year. Cadillac's almost a shoo-in to have the item on its '75s and there's a fair chance Chevrolet will latch on to the feature for its top-priced cars. Ford also thinks well of the idea and is working on a me-too version.

The movable pedals make sense for a reason that won't become apparent for a couple years. The government is talking about a standard that would require seats to be bolted down in a fixed position. No more adjustable seats. This wouldn't present a problem for tall drivers, because they can cock their legs at the knee. It's not a comfortable way to drive, but you can do it. But if the seat is nailed down—permanently anchored to the frame—the under-average-size driver is going to have a tough time stretching to reach the pedals. That's no problem if the pedals can be moved up to compensate for what the driver lacks in length.

## Detroit to nullify gas stickers

Auto manufacturers apparently have a tacit understanding they won't try to cut each other up by using the fuel consumption labels on the '74 cars to claim one make is superior to another because it gives better mileage. The companies are putting the mileage stickers on at the urging of the Environmental Protection Agency. But they aren't happy about it. What happens if one company decides to promote its mileage figures by downgrading a competitor's car? It could happen, but it isn't likely.

As Chrysler said in a statement to EPA, it's common knowledge that small, light cars use less fuel than big, heavy cars. If you want to play the numbers game, Chrysler adds (as a threat?), "the chances of serious injury and death increase dramatically as the weight of the car decreases." In other words, if anybody builds a sales pitch around the gas numbers, they can expect a counter blast relating death statistics to vehicle size and weight. That ought to cool off any name-calling based on mileage claims. But that doesn't stop you from making the rounds of dealers and checking the mileage labels. ★ ★ ★

Model 340 BB, Model 342 Cal. 22  
Pellet, Model 347 Cal. 177 Pellet.

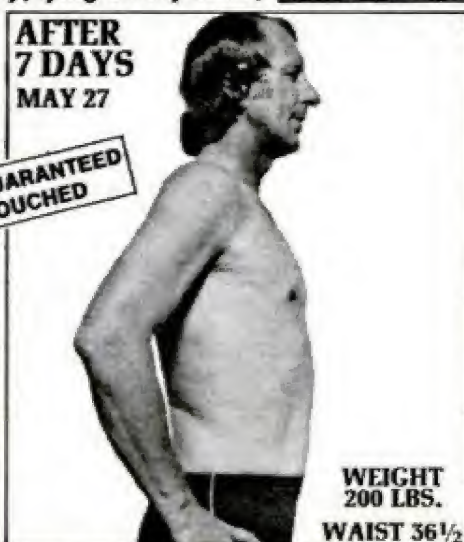


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One 5-Minute exercise, twice daily, lying on my back, without giving up the foods I love... Did It!



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### WHAT IS THIS INGENIOUS PLAN?

The Weider "5" Minute Body Shaper plan is based on doing ONE CONTINUOUS RHYTHMIC CO-ORDINATED EXERCISE while still eating the foods you like. That's all you do! This one five-minute exercise is designed to attack the Waist and Hips (where fat accumulates quickest, giving your body a flabby, weak and distorted look) — as well as burn off excess body fat fast by speeding up your metabolism, burning up stored calories and releasing excess water—while reshaping your chest, abdomen, firming up your legs and arms — your total body!

It's safer than strenuous workouts, beats the time consumption and dangers of gym workouts....or any other vigorous sport.

The unit weighs about 16 oz. and fits any wallet-sized case. You can carry it and use it wherever there's floor space — anytime. Even while watching television.

### WHAT COMES OFF IN 14 DAYS?

Individual results vary, but during an average 14 day period, you can expect to lose up to four inches from your waistline and up to ten pounds off your present weight. It strengthens your heart and lungs, increases stamina and endurance, improves your digestive function and general health. IT TOUGHENS YOU UP. For a "5-Minute Exerciser" — it sure does a lot!

### WHAT SATISFIED CUSTOMERS SAY:

Results vary depending on how much overweight each of our students is. Nevertheless, this is a sampling from the impressive letters we receive: Willie Ellis — "I lost 3 inches off my waist and 9 pounds in 7 days." Kent Christensen — "I lost 5<sup>1</sup>/<sub>2</sub> inches off my waist and 20 pounds in 10 days." Marino Zoller, M.D. — "I lost 2 inches off my waist in 14 days." Michael Benedict — "I lost 6 inches off my waist and 22 pounds in 21 days." Ken Waller — "I lost 3 inches off my waist in 5 days."

### WHAT THE EXPERTS SAY:

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"Doctors have always known, exercise done while lying on the back virtually eliminates strains while slimming and reshaping the body. Yours is the finest Body Shaper Program on the market."

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"Based on sound physiological and medical knowledge, it burns fat and shapes the body without strain to the heart or other organs. I lost 12 lbs. of excess weight using it."

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### \*EXPOSING EFFORTLESS EXERCISERS

Reader's Digest (Sept. 1971), New York Times and Good Housekeeping, among others, exposed sauna wraps, inflated belts, weighted belts and effortless exercisers as frauds. Scientific researchers, medical and fitness experts all agree....there is only one way to firm, shape and trim up your body... you must work the inches off!

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Because this isn't a "gimmick" plan — and you have been fooled in the past by "effortless exercisers" — I make you this UNCONDITIONAL GUARANTEE: "GET IT OFF FAST" — and see measurable and firming results in three days or return the exerciser for a full 100% refund! Proven results are already verified. The guarantee is in writing. Now, can you think of a reason for not ordering your "5-Minute Total Body Shaper?"

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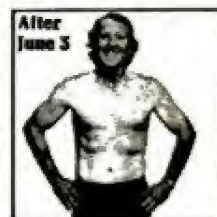
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# HINTS

## FROM READERS



### Plastic washers

If you need resilient plastic washers, try cutting them from the polyethylene covers of food containers, such as those in which soft margarine is packed, or from the lids supplied with cans of ground coffee. You can form the washers with punches, a gasket cutter or a sharp knife.

—Walter E. Burton, Akron, Ohio



### Spring-driven punch

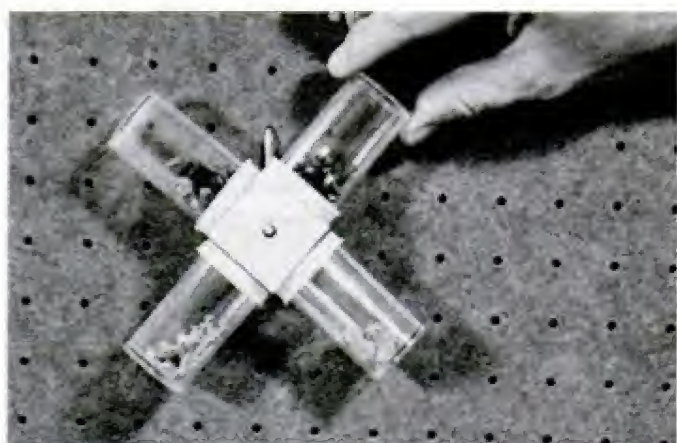
A sliding-hammer prickpunch that usually requires two hands to use can be adapted for one-hand operation. Slip a light compression spring onto the shaft between hammer and punch handle, then replace punch head. Hold tool on the spot to be marked, lift and release hammer with a snap.

—Peter Legon, Malden, Mass.



### Nonmarring twist-drill stop

To limit penetration of a drill bit through sheet metal when making holes for self-tapping screws, a stop can be made from an empty fountain-pen cartridge (Sheaffer) and a piece of  $\frac{3}{8}$ -in. o.d. aluminum tubing. About  $\frac{1}{8}$  in. of cartridge projects past tubing, acting as a cushion to reduce marring of the work.—E. B. Walters, Chicago



### Small-parts containers

Pill bottles are excellent containers for small parts in the workshop. They are even more useful when grouped as shown here. The caps are fastened to a cube of wood, through which a hole has been drilled, allowing it to be hung on a standard hook for perforated hardboard.

—Ken Patterson, Regina, Sask.



# WHILE YOU'RE WARMING UP YOUR CAR, YOU COULD BE WEARING OUT YOUR ENGINE.

You've probably heard many times that you should warm up your car engine a little before driving off, but a lot of people have a tendency to overdo it.

They let the car run while they're having their morning coffee and figure that when the seat is warm enough to sit on, the engine is warm enough to start traveling.

It's a very comfortable misleading myth. And we'd like to explain why.

When you start cold, extra fuel is delivered to the cylinders because the automatic choke provides a rich mixture of gasoline and air.

The extra gasoline washes some of the protective oil off the cylinder walls and piston rings. As this continues to happen, you get more and more wear on these parts. And the oil in your crankcase is diluted with gasoline.

The right idea is to get the engine up to a normal operating temperature as quickly as possible, after a brief idle period to assure that engine oil pressure is normalized. The automatic choke will then turn off and the engine will get to a normal, leaner mixture sooner.

This getting to a normal operating temperature is best done by driving. Not by standing still.

Of course, there are other ways of minimizing wear. One of them is by choosing the proper grade of a high-quality motor oil to put in your crankcase.

We at Gulf take great pride in the quality of motor oils we produce. In fact, our top line oils are named Gulfpride. If you stop at one of our Gulf dealers, he'll be happy to tell you about them or anything else you'd like to ask about your car.

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"Electro-Lab" is a registered trademark of the Bell & Howell Company.



If you're already handy with a set of tools, here's a way to pick up a pretty thorough knowledge of electronics: build yourself a solid-state color TV as part of a complete learn-at-home program from Bell & Howell Schools.

This important project gives you valuable "hands on" experience with solid-state circuitry—the kind of *practical* experience you'll need to build a successful career. It's a vital part of your total electronics education.

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#### Fix stereo systems... FM-AM radios... phonographs... tape recorders

With your new skills, you can build and service stereo-hi-fi systems—including FM-AM radios... phonographs... open reel tape recorders and cassette or cartridge player/recorders. You could even build yourself a complete "home entertainment communications center"—complete with the new gadgetry of cartridge television when it comes out. The skills you build by following this unique program are more than enough to service almost any type of home entertainment electronics device.

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It doesn't matter if you've never had any training in electronics before. Nobody's going to start throwing "diodes" and "capacitors" at you right off. You start with the basics. You take it one step at a time. You walk before you run. And you'll be amazed at how quickly you start to feel comfortable with things that seemed complicated at the beginning.

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In case you run into a sticky problem—or you want to discuss your project with an instructor—come in and see us. We've scheduled special "help sessions" regularly at the Bell & Howell Schools and in many other cities throughout the U.S. and Canada. Drop by. Meet an expert instructor in person. Talk over any rough spots with him—and with other students. You'll enjoy the chance to "talk shop."

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52BR



## CAR CLINIC

BY MORT SCHULTZ

### Racked up

*Because of limited trunk space, I would like to install a luggage rack on the roof of my 1972 Comet. However, there is no rack made specifically for this car. A visual check suggests that the rack made for the Pinto Runabout might fit. The dealer can't tell me for sure and says that he won't make the attempt unless I agree to buy the rack whether it fits or not. I would like to have some assurance before spending \$50, so I'm turning to you.—Glenn Murphy, Frankfort, Ky.*

The luggage rack made for the Pinto Runabout will fit your Comet if your Comet is a two-door model. Another possibility you might consider in order to increase the car's luggage capability is to install a rear-deck luggage rack rather than a roof rack. A rear-deck rack is made for your car and is labeled part No. C9AZ6255100A.

### Toss-up

*I have heard that riveted brake linings are superior to bonded brake linings. Is this true?—W. A. Lee, San Francisco, Calif.*

Quality brake linings are superior to inferior brake linings, and here the difference ceases. However, it's my opinion that riveted linings do provide one advantage. They issue a "warning" in the form of a squeal when lining wear is approaching the critical stage. This noise is produced when protruding rivets rub against the brake drum. With a bonded lining, squeal indicates the lining wear has proceeded beyond the warning stage and the webbing is striking the brake drum. This may cause drum distortion.

### Water torture

*My car, a 1971 Plymouth with 318-cu.-in. engine and dual exhaust, expels a substantial amount of water from both tailpipes in cold and warm weather. This has resulted*

*in two mufflers and a tailpipe rusting out in one year. Please help.—R. L. Williams, Jacksonville, Fla.*

Chrysler Corp. advises that this is not an unusual occurrence with a car that isn't driven "extensively." However, you might have a bad head gasket. Coolant can leak past a bad gasket and be expelled through the exhaust system. Check the gasket by putting the cooling system under pressure overnight with a cooling system pressure tester. Next morning remove sparkplugs and check for moisture at the tips. The presence of moisture verifies a bad gasket.

### Hub-cap hubbub

*The hub caps of my 1973 Chevelle are too loose. How can they be tightened?—Glen Remington, Denver.*

Owners of 1973 Chevilles, Monte Carlos and Camaros with this problem will be happy to learn that hub caps may be tightened by bending the retaining tabs (four small projections) slightly. Only a slight holding force is needed to keep hub caps gripped securely, so don't overdo it. Bending a tab too much will snap it. Test to see if a hub cap is tight enough by trying to rotate it on the wheel. If there's sufficient friction, the hub cap is secure.

### Glowing report

*The alternator indicator light of my 1971 Ambassador began to glow three months ago and hasn't gone out. The alternator has been checked, and output is 60 amps. The regulator has been replaced, but that didn't extinguish the glow. The battery has not lost its full charge either. In other words, the car is operating perfectly except for that menacing glow. How do I get rid of it?—Arthur Saumier, Detroit.*

Probably by replacing the triode plate (also called the diode trio) in the alter-

[\(Please turn to page 42\)](#)





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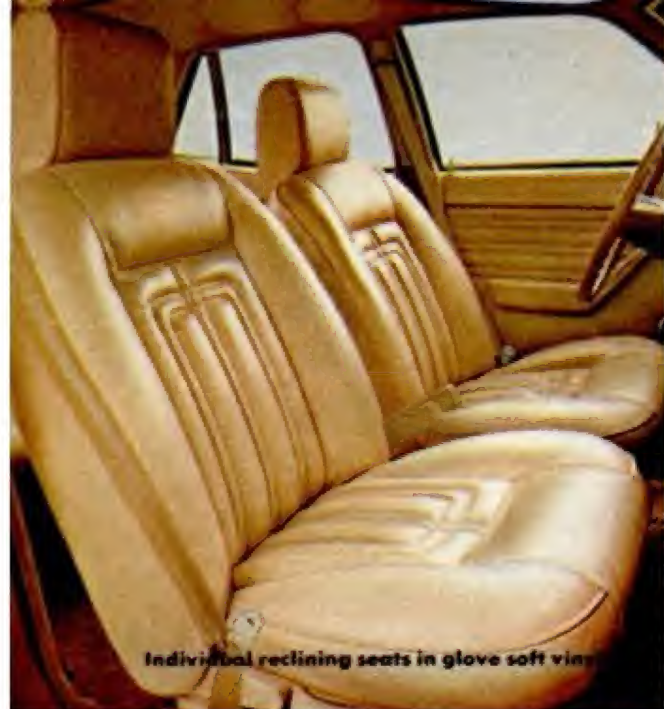
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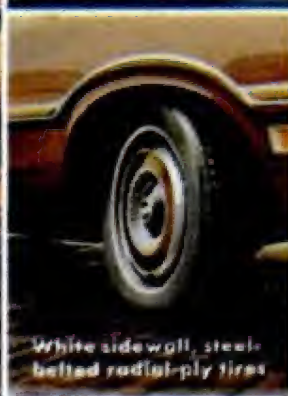
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### CAR CLINIC

(Continued from page 40)

nator. The triode provides a sensing voltage to the alternator regulator. The indicator light receives current from the triode. If there is an imbalance in voltage resulting from a faulty triode, the indicator light will begin to glow.

To find the problem, connect a voltmeter between the output terminal and the regulator terminal of the alternator with engine running and lights and heater blower motor turned on. A reading of over 0.6 volt indicates a faulty triode.

If you don't want to replace the triode, which costs about \$25, no harm will be done. You can get rid of the glowing light by installing a heavy-duty bulb and socket adapter contained in a kit (part No. 3207588).

### Hunting down a hum

*A hum from the rear of my 1971 Pontiac Ventura occurs between 50 and 60 mph. The dealer has told me to live with it—that*

*there is nothing wrong. Is he telling me the truth?—Matthew Korecki, Philadelphia*

There definitely should not be a noise. However, it is very difficult for someone to pin down the cause without at least being able to drive the car. Several things may cause a noise—a bad bearing, for example. Unfortunately, determining whether there is a bad bearing in the rear entails disassembly of the differential and examination of each bearing for damage.

There is one way you can try to pinpoint the problem area. Inflate the rear tires to 50 p.s.i. and road-test the car. If the character of the noise is changed, then noise is probably being caused by tires.

I have consulted Pontiac about this problem, and the company has told me to tell you that you should have your dealer contact the customer service department at the company's Philadelphia zone office if he can't resolve the problem.

### Hard to resist

*The problem I'm having with a 1969 Nova, 250-cu.-in. engine, is really baffling. I am*





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*now on my third coil. Checking at the coil positive with the engine running, I find that the coil is receiving 12 volts when it should be getting only a maximum of 8. With the resistance-wire bypass at the starter solenoid disconnected, I still get 12 volts at the coil positive. The ignition system seems to be wired correctly if one is to believe color coding.*

*In other words, it seems that the resistance wire has failed and is allowing too much juice to flow; which is hard to believe. I would expect a failure either by grounding, or by complete or partial breakage, which would give too little juice. What do you think?—William Vosseller, Perth Amboy, N.J.*

Try this theory. Just suppose that someone replaced that resistor wire with a wire having no resistance. What would you get at the coil positive? Right—12 volts.

Add a resistor or a resistor wire rated at 1.80 ohms.

### SERVICE TIPS

☐ **Sticking key?** If you have trouble getting the key out of the door or trunk-lock cylinder, the problem may be insufficient lubrication inside the lock cylinder. Inject some silicone lubricant, such as Dow Corning 4X, into the cylinder. Insert and withdraw key a few times to disperse lubricant.

☐ **Ford** advises that 1971-73 models with C-6 automatic transmission may lose transmission fluid through the vent if operated at 70 mph or more when air temperature is 80° F. or higher. The company suggests you judge your driving conditions and if they meet these criteria that you reduce the transmission fluid to the "Add" mark on the dipstick after the car has been driven sufficiently to bring the fluid to operating temperature. It's at this temperature when the dipstick is too hot to hold at the shaft.

☐ **Olds owners:** Windshield-wiper blade chatter with 1971-73 Oldsmobile 88s, 98s and Toronados may be a thing of the past. Dealers now have a new shroud top vent screen (part No. 9688242) to reduce pressure on wiper-blade inserts. ★★

**GOT A PROBLEM WITH YOUR CAR?** Ask Mort about it. Send your question to Car Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. Letters cannot be answered individually, but problems of general interest will be published in the column.





1933



1973

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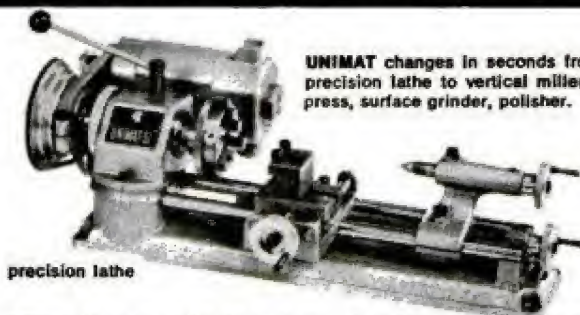
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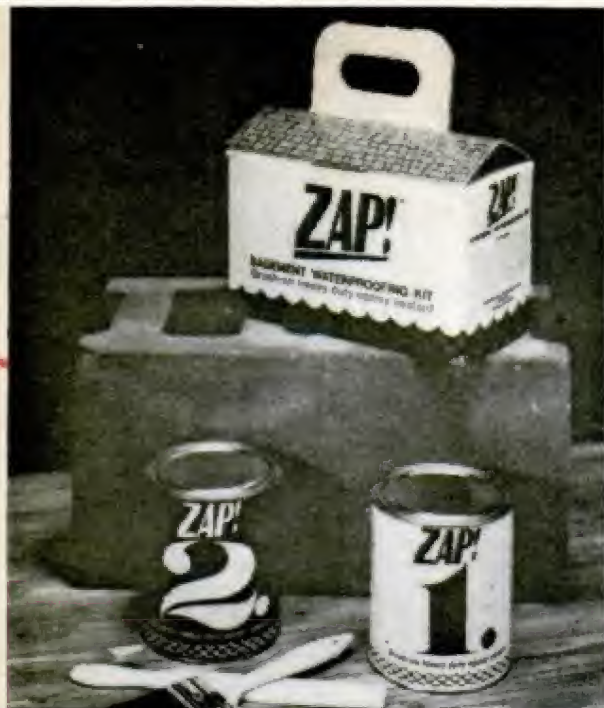
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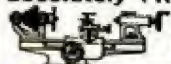
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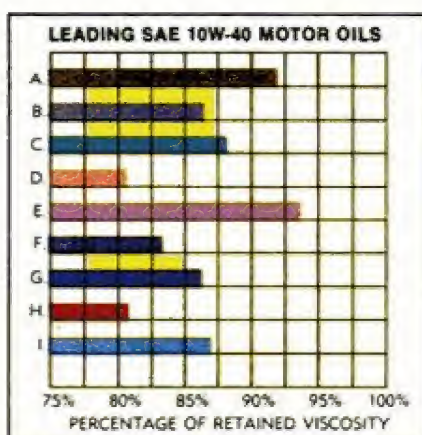
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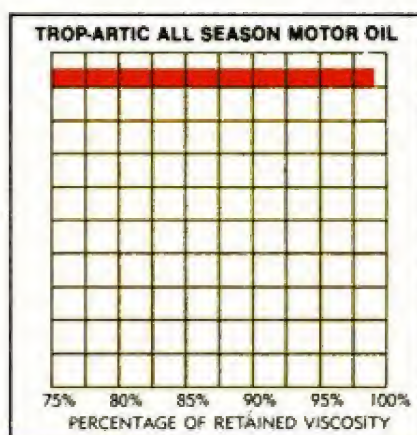
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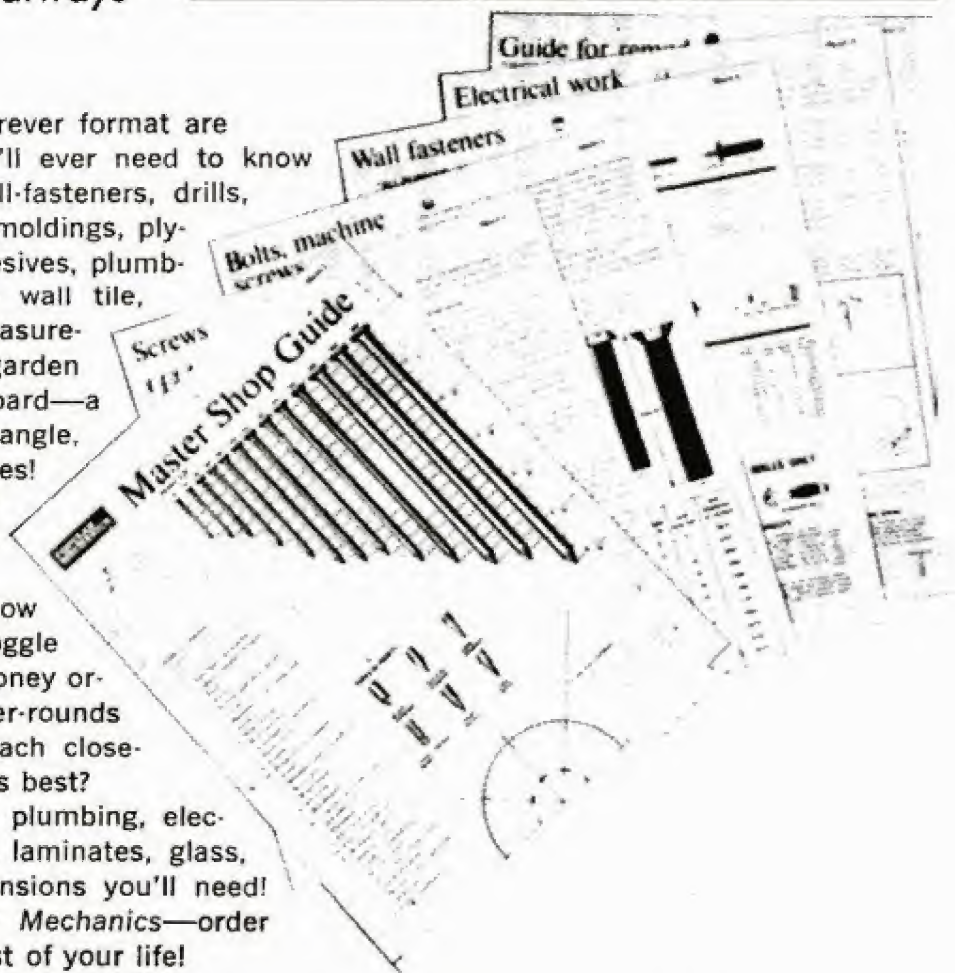


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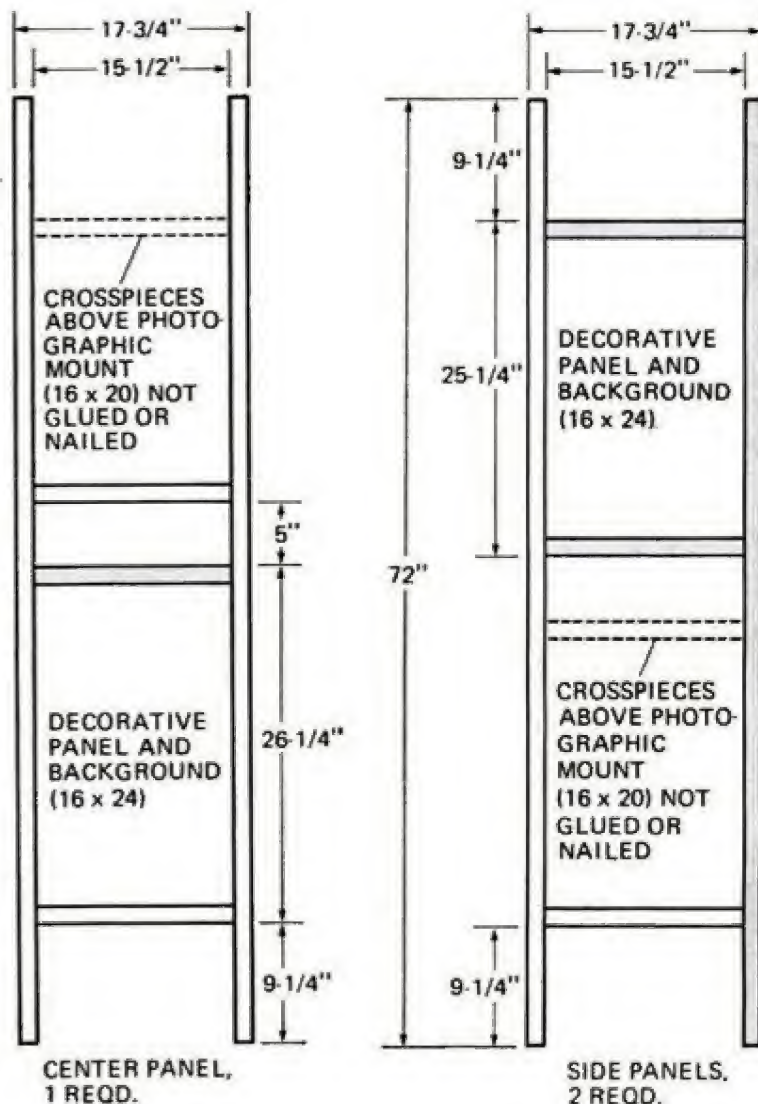
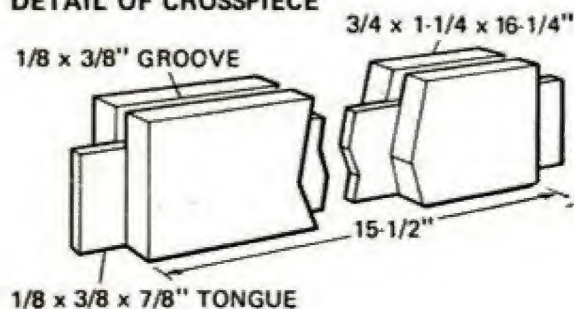


# PHOTO HINTS

## FROM READERS



DETAIL OF CROSSPIECE



### Folding screen displays photographs

This folding screen serves as both a room divider and a display for photographs—and the photos are easily changed.

Construction is simple, with each section built individually, then attached with folding screen hinges. Materials are readily cut from 1x2 stock, and can be cut for you by a lumberyard. Both the vertical and horizontal pieces have grooves 1/8 in. wide by 3/8 in. deep along one edge to hold the panels; the horizontal pieces also have 3/8 x 1/8 x 7/8 in. tongues to fit grooves of vertical supports.

Each section was assembled with glue and small brads, but the horizontal pieces above the photos were not glued or nailed, so the photos could be changed easily. Decorative panels are of 1/8-in. plywood or hard-board filigree, stained or painted before the watercolor-board backing is applied. Photo panels used are the standard-size 16x20-in. print mounts, and the prints are attached either by dry mounting or through the use of print-mounting adhesives.

—Ben Pilcher, Abilene, Tex.





#### Film-type reminder holds film box lid

Trace a film box's end flap on a scrap of aluminum flashing, and cut with metal snips (or scissors), leaving enough metal around the outline to allow three bent edges as shown (box end flaps slip in the open end). Bend with pliers, sand and glue or epoxy on. —George Daniels, Danbury, Conn.

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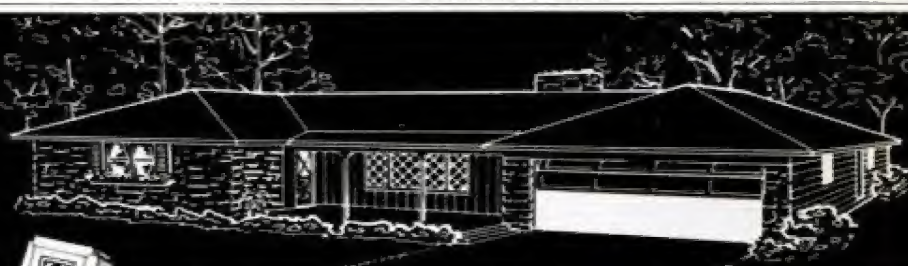
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## THE BICYCLE SHOP

BY EUGENE A. SLOANE

### Will it work?

*I would like to install a wide-range free-wheel (13 to 31 teeth) on a Gitane that has Simplex dropouts, using a Campagnolo Nuovo Record derailleur. I have been told by the dealer that Campy derailleurs won't work on Simplex dropouts. Is this true? If so, what derailleur would you recommend for use with the wide-range freewheel gear cluster?—Ernst Ginkel, Glendora, Calif.*



First of all, the Nu-ovo Record derailleur is designed to handle gears from 13 to 28 teeth only. I have seen it used on up to 34 teeth, but the shifting is erratic; sometimes it will get up to the bigger gears, sometimes it won't (usually when you need it most). I recommend the new Shimano Crane GS wide-range derailleur (photo), which is lighter and works better than the Campagnolo Gran Turismo wide-range derailleur. You should be able to buy it in your bike shop. This derailleur should work on the Simplex dropouts.

### Bike for a heavyweight

*I am six-feet-six and weigh 300 pounds and would like to bicycle. Is there a bike built for me?—Glenn Vernor, New York.*

You can buy a conventional 10-speed bicycle with a good chrome molybdenum or manganese steel alloy frame, such as one of the better Schwinns or Raleighs, that will be plenty strong for you. But you may have spoke breakage, in all probability on the rear wheel, particularly if you do much touring over long distances and carry baggage. (Of course, if you ride like that, you'll drop some of those 300 pounds along the way.)

I would suggest you have your dealer re-

move the rear 36-spoke rim and hub and lace up a 40-spoke rim and hub to handle the greater load. He might use heavier tandem spokes, too. I would think that the front wheel with a 36-spoke hub and rim would hold up.

You could also lace and true the wheel yourself (see *The Bicycle Shop*, page 21, March PM, and page 40, April PM).

### Derailleur-chain master link

*Can a master link be put on the chain of a five-speed derailleur bicycle?—John Austin, Greenwich, Conn.*

No, because these narrow 3/32-inch-wide chains would then be too wide to fit over freewheel gears if equipped with a master link. The chain would rub if so equipped. I suggest you buy a chain rivet remover



(photo) and learn how to use it (see *The Bicycle Shop*, page 31, April '72 PM) so you can take your chain off for cleaning. Carry this tool with you on trips because you can break a chain link, and the chain rivet remover makes it easy to repair the chain in minutes.

### Wants 28-inch tires

*Where can I buy 28 x 1 3/8 and 28 x 1 5/8-inch tires and tubes?—H. True Hill Jr., Safford, Ala.*

If your Raleigh dealer can't supply them (Raleigh makes a 28-inch bike that's sold in

*(Please turn to page 54)*



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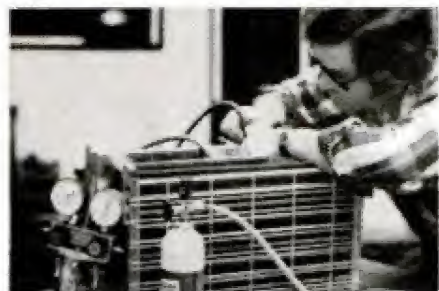


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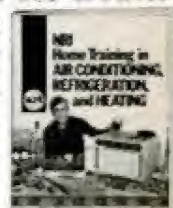


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## THE BICYCLE SHOP

(Continued from page 52)

the United States), you can get them from a bicycle mail-order house such as Wheel Goods Corp., 2737 Hennepin Ave., Minneapolis, Minn. 55408. These tires are listed on page 109 of their \$2 catalog.

### Direct-drive bicycle

*I heard that someone has made a bicycle without a chain but with direct shaft drive. Have you ever heard of such a bicycle?—Steve Butler, Rapid City, S.D.*

A number of firms made such a bicycle around the turn of the century. One such bike is shown in the photos below. Other



makes hid the shaft in the right-hand stay. This transmission system was abandoned because it was less efficient than chain drive and a lot heavier.

### Tools for a crank

*I have a bicycle with a Nervar cotterless crankset. Where can I find tools to remove it? What do you think of this crankset?—James Langley, Concord, N.H.*

If you can't find a Nervar cotterless crank remover, the Campagnolo crank puller will fit the Nervar crank. But the Campagnolo nut wrench is too big. The Nervar crank locknut is either 13 or 14 mm, and any thinwalled box wrench that size will fit. I suggest you review crank removal and disassembly instructions in the May '72 *Bi-*

*cycle Shop* (page 67) or page 293 of my book, *The Complete Book of Bicycling* (Trident Press, \$9.95). It's easy to ruin these cotterless cranks unless you know how to take them apart properly.

### How good is 'good'?

*Do you think a 10-speed bicycle for \$62 is a good buy?—Kenny Bachman, New York.*

No, because a bicycle at that price will have heavy, cumbersome, awkward components and frame. This will be a heavy clunker that will be hard to pedal, hard to repair and hard to have fun on. Of course, such bikes have their uses. If you need it to ride to school where it might be stolen, it would be a good buy. Or for strictly utility use, a few miles at a time, it would be okay.

### Cinderella conversion

*I would like to change the frame of a Schwinn Varsity 10-speed for a lighter frame of Reynolds '531' or Columbus tubing. Is this possible, and how much would it cost?—Anthony Orrico, Jersey City, N.J.*

You could, but it would be like hanging low-cost parts on a Rolls Royce. I recently bought a '531' frame made in England, and even with a friendly dealer discount I still paid \$175 for the frame only. The Varsity is a good, sturdy utility bike that will take a lot of abuse, but it's not in the same class as a bike with a '531' frame. If you want a good bike, why not buy a good bike (see *Eugene Sloane Picks the Best Bikes for Your Family*, page 98, June PM). You can buy a good bike with a '531' frame for around \$250.

### About self-addressed envelopes

Many readers send me questions with self-addressed, stamped envelopes so I can answer them directly. I regret that the volume of these queries makes individual answers impossible for me; there are just not enough hours in the day. (I probably never will get hardened enough not to regret being unable to give individual replies to those who ask for them.)

I'll continue to answer all the letters I can in this column. ★★★



## SCIENCE WORLDWIDE



### Curing a cast with light

A new type of cast for broken bones—said to be 50 percent lighter and three times stronger than the conventional plaster of paris cast—has been developed by Merck Sharp & Dohme Orthopedics Co., West Point, Pa. A cast is made by slipping a polypropylene stockinet over a broken arm or leg, then wrapping it with an open-weave fiberglass tape impregnated with a photo-sensitive plastic resin. The cast is cured by putting it under a special lamp that generates light of a frequency near the ultraviolet part of the electromagnetic spectrum. The light causes the resin to harden, a process that takes about five minutes.

### Football helmet: dangerous weapon?

Though protective equipment for football has been improved in recent years, the helmet could be made safer. That's the view of Dr. Richard W. Corbitt, chairman of a sports committee of the American Medical Assn.

"The hard plastic covering of the helmet and shoulder pads is a significant source of injury, in terms of its impact on an opposing player," says Dr. Corbitt. "The more

so because many coaches today still teach players to use the head when hitting." Dr. Corbitt's committee recommends a soft outer covering for pads and helmets.

### Coming: close-ups of Mercury

Next March, a Mariner spacecraft equipped with TV cameras is scheduled to fly within 600 miles of Mercury, a planet difficult to observe from Earth because of its extreme closeness—36 million miles—to the sun. The purpose of the flyby is to determine the orientation of the planet's spin axis and to obtain information for making maps. Earth-based telescopes can distinguish only gross characteristics of Mercury.



### A quick way to 'shovel' snow

Snow accumulations could cause the collapse of an air-supported structure used at the University of Alaska to house a hockey rink and tennis courts. In the past it was necessary to deflate the bubble to allow workmen to clear it by hand—a slow and costly process. But now the job is done cheaper and faster by a small helicopter equipped with floats. The downdraft from

*(Please turn to page 56)*



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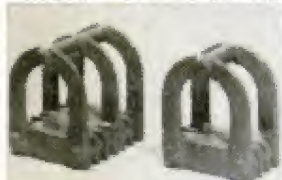


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## SCIENCE WORLDWIDE

(Continued from page 55)

the rotor is powerful enough to blow away loose accumulations. The copter's floats are used to crunch down on—and break apart—patches of snow that have crusted over.

## Fish tag transmits temperatures

A temperature-sensitive, ultrasonic fish tag has been developed by environmental scientists at the Oak Ridge (Tenn.) National Laboratory. The device can be surgically implanted to measure fish body temperature, or attached to the skin to measure water temperature.

Powered by small batteries, the tag transmits readings by acoustic energy. The signals are received on shore or in a boat by means of a hydrophone system.



## Bugler brings in the herd

Soviet researchers are slowly domesticating a herd of 45 elk on a farm some 60 miles west of Moscow. Over a period of years, the elk have overcome their fear of humans, the females even allowing themselves to be milked. The animals have been conditioned to respond to the sound of a bugle, gathering at a clearing where they are rewarded with salt and bread. The successful domestication of a cold-region animal like the elk could mean more protein for Alaska and Canada as well as Russia. ★ ★ ★

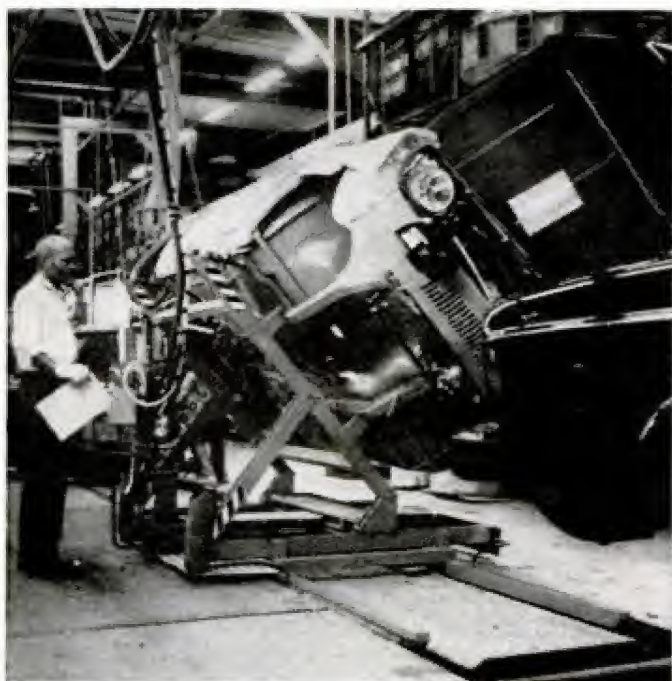


## IMPORTS AND MOTORSPORTS

### Volvo in Virginia

When the 1977 Volvos start coming off the assembly line at Chesapeake, Va., in the fall of 1976, Volvo officially will be the only foreign car manufacturer building cars in the United States. The Swedish company will break ground for the \$100-million plant next month. Among the innovations to be used for production is the "tipper trolley" shown below.

It was feedback from assembly-line



workers at Volvo's plant in Sweden that led to development of the trolley. This allows heavy components like fuel tanks and exhaust systems to be fitted from the side rather than from a pit below.

The decision to build here reflects a continuing commitment to the American market where Volvo sells 25 percent of its passenger-car production. The plant will employ about 3000 workers and all cars produced there will be sold in the United States. Capacity is planned to be 100,000 cars annually by the late '70s.

Parts for the cars will come from American and European suppliers and production at the plant will include body assembly, surface finish and final assembly.

### Saab in '74



A new model from Saab will be available in the spring. The 99 LE Hatchback version of the 99 has a redesigned back end with a hatch that may be bigger than any you've seen. A couple of years ago we suggested to the Saab engineers in Trollhattan that America needed the likes of a 99 station wagon—sensibly sized, safe and economical—but they showed no interest. Now we know why: They had something much better in mind than a box of a wagon!

The Combi Coupe, as it's called in Europe, and all the other two-liter 99s for '74 are now fuel-injected. Other features for '74 include redesigned front seats, improved flow-through ventilation and, on automatic transmission models, the power steering owners said was needed ([See PM Owners Report, page 106, Aug. '72 PM](#)).

And since it's about time we started "thinking metric," because the United States is in the process of switching, Saab

*(Please turn to page 58)*





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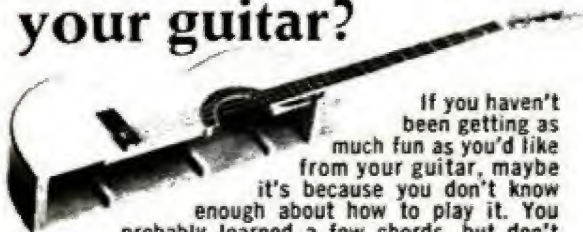
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## IMPORTS AND MOTORSPORTS

(Continued from page 57)

has both kilometers/hour and mph scales on its speedometer. One kilometer equals .6214 miles, so a speed of 100 km/h is equal to 62.14 mph. Got it?

### Audi outfoxed

It started out as an Audi 80, or the Fox as it's called here, before Karmann and Ital-Design gave it a new shape for the Frankfurt International Auto Show. The wedge-styled four-seater is a one-off show car, of course, but incorporates ideas that



may find their way into production. Most unusual inside the car is the instrument display. Gauges and indicator lights are in a big, cylindrical, bolster-like dash with viewing apertures for the driver.

### Beat frostbite

They're fleece-lined pockets with heavy outer shells and are called "Hippo Hands." The left one even has a little pouch in it for toll change. If you want to ride all winter, write Vetter Fairing Co., Box 927, Rantoul, Ill., for more information. ★★★





## ALL OUTDOORS

BY BILL McKEOWN

**H**ere is our year-end selection from the mountain of sports items now available—a few of the essentials we'd want to take along to a desert island or anywhere else. Our choices have been field-tested from the near-arctic regions to the tropics—and many camp spots in between. Several are new or improved; others have been durable companions over a number of years. They have earned their keep and carrying weight on ski and snowmobile safaris, backpack, RV, hunting and fishing trips, inland floats and offshore cruises. Reliability and exceptional performance were requirements for top rating. All are available by mail order or from local outlets.

A new down sweater, which is actually a jacket that compresses tightly into a stuff sack, we find useful under a ski parka, beneath foul-weather gear in a blind, or offshore during a winter norther in the Caribbean. Ours came by mail from Recre-

ational Equipment Co., the Seattle campers' co-op. This all-purpose item gets squeezed into our backpack or baggage for every trip and is now available from a number of mail-order suppliers and sports outfitters.

The Thermos Pop Tent has been around a number of years. Many tents are lighter and smaller, but when out camping by car, recreational vehicle, ATV, 4WD mountain goat or boat, we like to have one. It can hold a camp spot if you must drive away, will store excess equipment or kids, add a room to a larger tent or smaller RV or boat, pop up or take down in minutes in a rainstorm. For backpacking, our selection is Camp Trails' remarkable four-pound Chaparral with waterproof condensation-controlled roof that needs no fly. But for fast general use, a vote here for the Pop.

**Modern outdoorsmen** know enough to come in out of the rain, but when that gets

*(Please turn to page 60)*

**VW is more money than Duster.**

**Duster is considerably more car than VW.**

**VW seats four.**

**Duster seats five.**

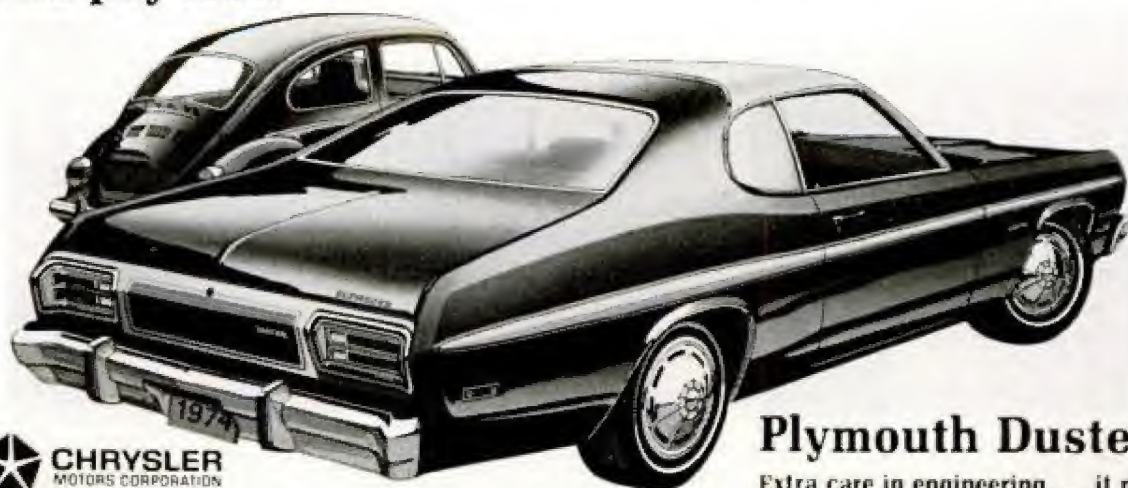
**Duster has three times as much trunk space as VW.**

**Duster delivers about twice as much horsepower as VW.**

**And it has more weight, wheelbase and width.**

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## MOWER SHARPENER

Precision-grind all hand and power lawn mowers—a perfect job every time.

## ALL OUTDOORS

(Continued from page 59)

difficult, high-quality foul-weather gear is the answer. A season-long test of parka-style Ted Williams-brand storm suits has failed to tear or poke holes in the rubberized nylon. Sears stores and catalog also list cheaper models, and drug-store plastic cheapies are less than \$1, but for a suit to fit comfortably over fishing clothes, ventilate without letting water in and last and last, we have found nothing better at anywhere near the \$16 price. And after fishing and shooting with perfectionist Ted Williams, it's easy to see why his approval carries such weight with Sears customers.

Sunsensor is the name Corning Glass gives its new updated lenses ground to a sportsman's prescription that automatically darken in bright light to a protective comfortable density. We find them particularly useful around water, but they rate as a bonus this year for any outdoor activity.

Short-section fishing rods that can take down to fit into a backpack, knapsack or glove compartment are now well enough made to rival the action of one or two-piece models. Fine fitted cases slide them easily and safely into almost any size luggage. A Zebco Travel-Pak rod-reel combination has been touring successfully with us by boat, air and RV for several years, and we have seen excellent new models from Berkley, Shakespeare, Orvis, Martin, True Temper, Daiwa, Heddon, Sears, and Garcia as well. Eagle Claw even has an eight-piece spin, cast or fly rod that fits inside its tackle box. Handy encased pack rods are one of the best trends of the year.

The Swiss Army knife earns its top rating partly by performance, partly by its finish as a fine instrument. None of its parts—scissors, screwdrivers, saws, even blades—are as rugged or easy to use as the full-size tools, but it is remarkably compact and handy, though expensive. Fine specialty knives that rate high are the Finnish Rapala filet models and the Normark Swede 45 that comes apart for easy cleaning.

Shoes for general outdoor wear now come from the best makers. We would top-rank our Herter's Hudson Bay Two-Point high shoe, but special conditions often require favorites like L.L. Bean's Maine Hunting Shoe, Herman Survivors and others.

Combining the old-time hard-to-start charcoal fire and flavor with easy-to-start LP-gas, Primus has come up with a fine

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new barbecue stove called a Campacue, that uses permanent ceramic coals. More improved LP models for full-size pots or backpacking come from Coleman, Gerry, Bernz-O-Matic, Zebco and others, improving campfire in every way except appearance.

There is no all-purpose outdoorsman's camera—or pack, gun or fishing lure—but the Nikonos underwater model can certainly survive more moisture and hard knocks out of water than most and still bring back fine pictures. We bought the first model, the Calypso, in France, and wore it for years through offshore races when we came back with broken bones, but camera and photos were undamaged. While not very light or small, the Nikonos is certainly a most durable outdoor camera.

Savage calls its over-and-under rifle/shotgun that folds into a canvas case a Campers Companion, and that's just what it is. With .22-cal. on top and 20-gauge shot or slug shell below, it's suitable for plinking on up. Regular shooters will choose one or more specialty models from top makers, but for a multipurpose single-shot just to have along, we'd pick this one.

That's 10 top items to take outdoors, and any, incidentally, would make good Christmas gifts for a sportsman. But we've tested or noted many other outstanding products and trends this past year. Outstanding outboard motor of this and many other years may be the Outboard Marine rotary which Evinrude and Johnson are expected to market some year soon. Top sports plane of the decade is our rating for the Pitts Special. Leading offshore high-performance powerboat, *Cigarette*, has an unrivaled win record. Fine for special purposes are Glastron Campers, Boston Whalers, Hewes Bonefishers, Aquasports and Terry bass boats.

Clothing for outdoorsmen introduced in 1973 has been outstanding, with much more variety and adaptability available than before. A camper can keep warm with gear like Eddie Bauer's down cap and mittens while packing along a Gerry Mini-Stove or a Kangaroo Cooker. We're glad to see large parachute-type bags available from Beckel Canvas Products and P & S Sales. First-aid pocket-size packs now come from Cutter. Bass fishermen can now buy the "Big O" and similar successful lures from several makers. Graflite carbon-filament extra-strength rods hold promise and are available from Fenwick and Shakespeare. Sportsmen seeking the best can find a lot to choose from this year's crop. ★ ★ ★



**Winnie Wagon** is latest in extensive Winnebago RV line. Van conversion raises roof for headroom, lowers it for garaging. Thermo-steel bodied unit will cost \$6915.



**Go-Joe**, a new four-wheeler from Rupp Industries, is claimed to be part motorbike, dune buggy, snowmobile, with speeds to 40 mph from a 2-cycle 8-hp Chrysler.



**Extension Step Bumper** for Chevy, Ford, Dodge, GMC and International pickups bolts on without welding, extends with camper mounted. From Kenco Engineering.

(More photos on page 62)



## ALL OUTDOORS

(Continued from page 61)



**Newest tent from Coleman** is Villa Del Mar with side-door entrance, seven large nylon-screened windows, three-color European look. The 9x12-footer sleeps five.



**Instant buoyancy for flies** results from new aerosol Dry Fly Spray LT 100 from Scientific Anglers, maker of Air Cel, Wet Cel fly lines and a new division of 3M.



**A workhorse** now available in seven colors, the 1974 International Scout with two-wheel or four-wheel drive can tow trailers to 5000 lbs. with equalizer hitch.

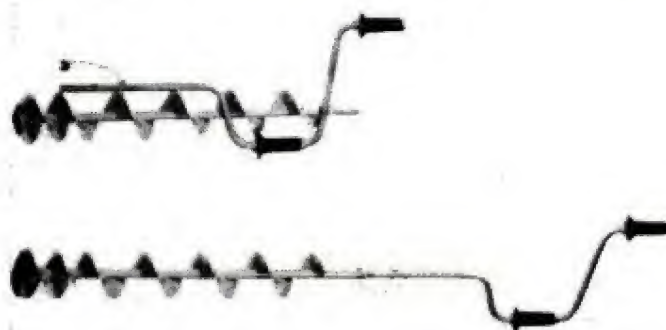
62 POPULAR MECHANICS



**Merc Sno-Twister 400-D**, newly added to Mercury Marine's snowmobile line, is high-performance 398-cc machine with slide-rail suspension designed for racing.



**Waving an orange flag** at fishermen when a fish strikes, the Pop-Up magnetic tip-up from the Worth Co., Stevens Point, Wis., is easy to set up on ice over fish hole.



**Cutting a five-inch** or seven-inch-diameter hole for ice fishing is easier with Jiffy Hand Ice Drill from Feldman Engineering, Box 153, Sheboygan Falls, Wis.





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Pocket a Pocket 40 for less than \$68. Other Pockets from less than \$23. Prices subject to change without notice.

**Kodak pocket Instamatic® cameras.**



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# HOMEOWNERS' CLINIC

BY W. CLYDE LAMMEY

## Peeling under windows

*Although I seem to have no such trouble elsewhere, the outside paint persists in peeling under several windows. I've done these areas over several times, but the paint still peels. What's the cause and remedy?—Harry Osbourne, Springfield, Mass.*

If you remove the trim pieces (aprons) under the stools (sometimes mistakenly called window sills), you will likely see a narrow crack or opening. Moisture from inside the room is forced through this opening by vapor pressure into the space between the inside and outside walls. From here it gets under the paint film and eventually lifts it. Brush the dust from the opening and fill it with spackling compound, forming a fillet with your finger. When the compound is dry, prime it with aluminum paint, then apply a coat of oil-base paint or enamel. This usually cures the trouble.

## Loose at the edges

*Vinyl tiles in my kitchen have loosened and turned up at the edges. Can I restick 'em or must I replace?—Robert Marion, Chicago.*

You might try running an iron, set on low heat, over the edges. If there is no accumulation of dust or wax under the edges, this can work. Be careful not to overheat and damage the tiles.

If the iron doesn't do the trick, you'll have to lift the edges, clean out dust and debris with a wire brush and work vinyl adhesive underneath. Wipe up any excess adhesive and weight the treated joints until the adhesive has set. This is the sure cure, but the job won't be quite as neat as it was originally—some of the turned-up edges may show in oblique light.

## Splintered tread

*One of my basement-stair treads is splintered at the edge. I don't know how it hap-*

*pened; the splinter just suddenly appeared. It's about two-thirds the length of the tread with one end still holding. Can it be repaired some way or should I replace the tread?—R. M. Desmond, Austin, Tex.*

Before replacing the tread I'd try a repair. If the splinter is still intact, it should fit back in place with little if any offset. Mix a small amount of waterproof glue; then pry the splinter up very carefully, just enough to work in the glue between the meeting surfaces. Cover as much of each surface as possible without breaking the splinter off entirely. Force it back into place and hold it there with strips of adhesive tape. Wipe away any excess glue. When the glue dries, sand the area smooth and repaint in matching color.

## Cove correction

*A short section of the cove base in my bathroom has loosened and won't stick back in place. I've tried twice; the cement hardens but won't hold. This section is about 18 in. long and at the side of the toilet bowl. What to do now?—H. Cole, Redwood City, Calif.*

It seems as if you didn't do a very thorough job of cleaning behind the cove. Usually the top end of the cove will loosen first, admitting dust and other debris. Unless this dirt is removed first, the cement just won't stick.

Do an all-out job of cleaning both the cove (scrape the old cement off the back, too) and the surface, then spread cove base adhesive (of a type appropriate for your cove material) as uniformly as possible with a notched trowel. Replace the cove and apply pressure if possible or use well set 4d finishing nails where required. ★★

*Do you have a home maintenance or repair problem? Send it to Homeowners' Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. While letters cannot be answered individually, problems of wide interest will be discussed in this column.*



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av. per cigarette, FTC Report Sept. '73



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# Spellbinders: optical fibers

**G**littering pinpoints of lights cascading from the tips of hundreds of optical fibers turn these unique table lamps into fountains of breathtaking beauty. Like so many tiny "weeping" straws bunched together at one end, the synthetic, tubular optical fibers have a special coating which keeps the light from "leaking" out the

side. The high-intensity light travels the full length of the core and spills out the ends.

Designed to enhance home decor, whether traditional, contemporary, Oriental, Mediterranean or Early American, these mood-setting lamps are great as TV lights and night lights and, when battery operated, they can be used as dramatic dining-table



**Table Tree** adds colorful, decorative holiday touch at Christmas time when fitted with a red or green filter; 14 in. tall, it's priced at \$9.99.



**Called Essence**, this beauty combines wood, acrylic and chrome with five light sprays, \$100



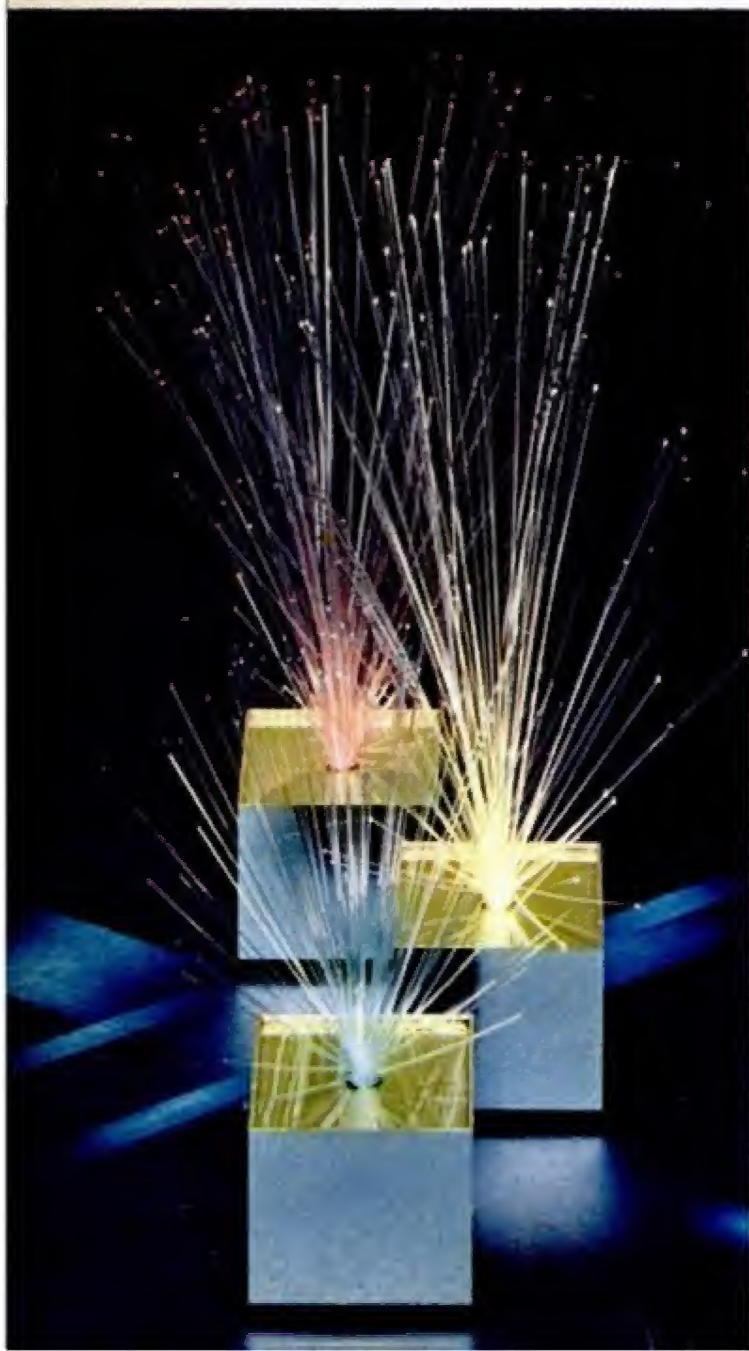
## Soft, delicate points of free-form light



**Dream Tree** is weeping willow with hundreds of tiny lights emanating from its realistic tree-like branches. Available in a put-it-together-yourself kit, it sells for \$17.50.



**Moby Glo**, a wood-tone ceramic whale, spouts spray of glimmering lights. For nautically inclined. About 8½ in. high, it costs \$25.



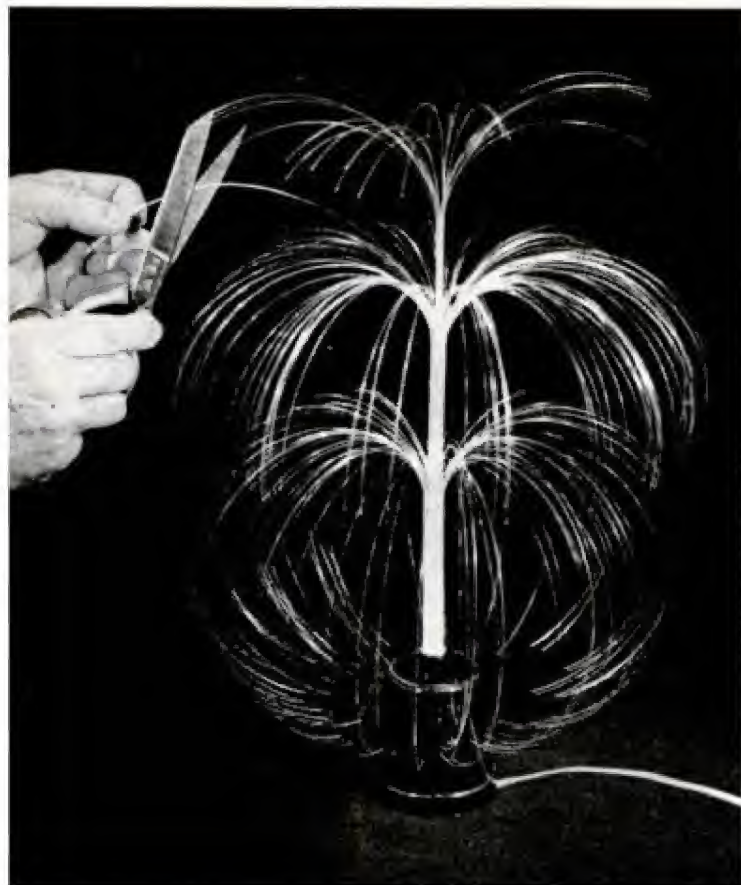
centerpieces. Manufactured by Poly-Optic, Inc., of Santa Ana, Calif., the lamps are available as complete ready-to-plug-in units or as kits in both plug-in and cordless types. The parts also can be purchased as individual components for anyone who wants to create his own designs.

The optical fibers come in two forms—loose and as complete sprays—in a variety of colors, lengths and thicknesses. Loose fibers are made into sprays by simply epoxying a metal collar to the bunched ends, and are easily trimmed to the desired lengths with scissors. Other components include a high-intensity light source and reflector, separating tubes, color filters and a transformer plug which reduces 115-v. house current to 7 volts. Illuminated by a No. 55 auto headlight bulb, the lamps cost about the same to operate as an electric clock. Cordless lamp kits are available, too, using two D-size batteries. ★★★

Photo at left: Ben Rose

**Star like** and bursting from silvered box vases, sprays of handsome cordless lamps are ideal for contemporary dining table. Named **Reflections**, about 15 in. tall, \$17.50 each.



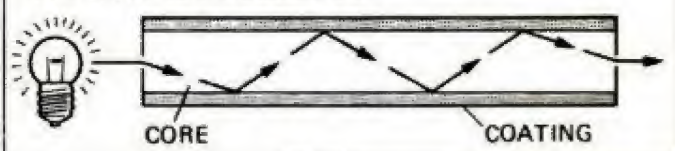


**Fountain Glo lamp** uses one complete spray which is divided into three separate sprays by "soda straw" slip-over tubes. Optical fibers are trimmed to the desired length with ordinary household scissors.

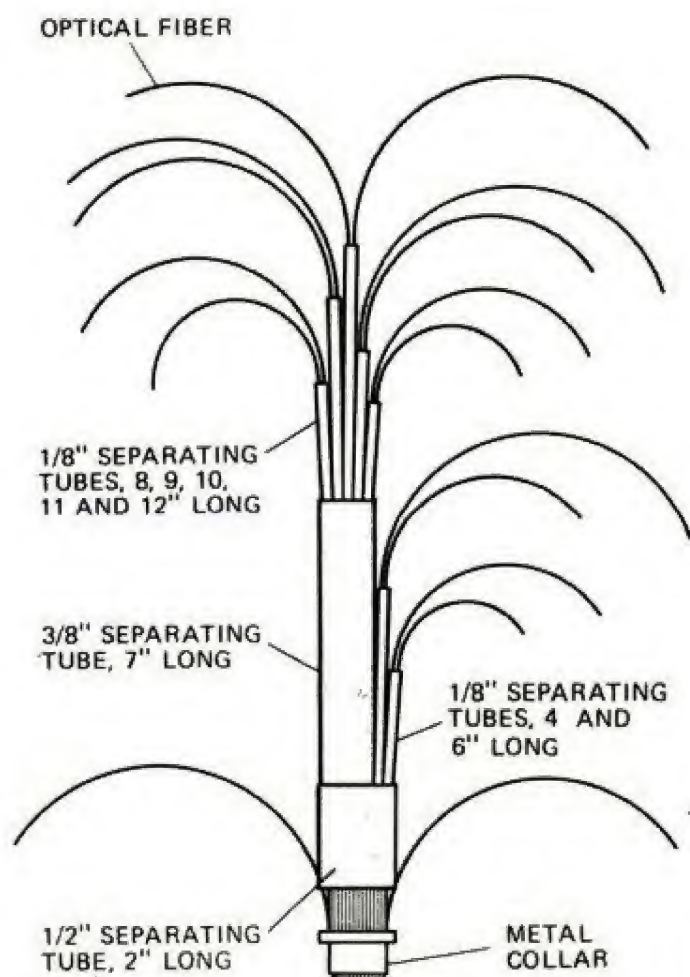


**This 24-page booklet** contains basic information on how to work with optical fibers and components. Can be obtained by sending \$1.50 to Poly-Optics, Inc., 1815 East Carnegie St., Santa Ana, Calif. 92705.

#### HOW LIGHT IS TRANSMITTED



**Like water passing through a hose**, light travels through core of fiber strands and out the ends in form of tiny starlike dots. Special coating prevents light from "leaking" out through the sides.



BASE



REFLECTOR



BULB AND SOCKET



TRANSFORMER PLUG

**Basic components of hobby kits** (above) also include complete spray already attached to metal collar. Electric kits have transformer plug to reduce house current to 7 volts. Two "D" batteries run cordless lamps.

**Drawing shows use of separating tubes** to produce various spray heights and tiered effects. Here, up to eight tubes are used to create complex sprays. Fountain Glo lamp (above) uses only three tubes.





**Delicate, frosty look** is special feature of snow-molded candles. One above was made with two pours of different wax colors.

**Each of the three candles** at right was made with a single pour of wax. Pink and green ones are "upside down" candles.

**Another two-pour candle**, below, shows the delicacy—and unpredictability—of results. No two snow candles can be alike.





# Free-form, one-of-a-kind candles are molded in snow

by Doug Dill

Photos by the author

Snow can be the mold you use to create candles that take on a frosty appearance, yet provide a warm glow for winter nights. Hot wax melts and changes its snow molds as it solidifies, producing unusual textures and shapes.

Snow candles are made with your favorite brands of candle wax, colors, scents and wicks. (For sources of supply and basic instructions on handling wax, see *Fancy Candles: Colorful Christmas Gifts*, page 114, Nov. '72 PM.) Snow becomes the mold. The process is like making sand candles except that the snow molds are not as predictable as sand and can result in pleasant surprises for the candlemaker.

If you live in snow country you can melt the wax in the normal fashion on your home stove. If you have to travel to the snow, a campstove makes a fine source of heat. In either case, use a double boiler, never direct heat.

Start making your molds in the snow while the wax is melting. Simply create a depression that wax can be poured into. Dangle a wick into the depression from a stick placed across its rim; the wick should be coated with melted wax and allowed to dry thoroughly before being placed in the mold. Wire-core wicks seem to work best.

There are two basic types of snow candles. The "upside down" candle is made by sculpting a design in the bottom of your depression in the snow. After the wax is poured and set, the candle is removed and turned upside down for use.

More unpredictable designs happen with the two-pour candle. After one pour has



Unique candles are created by pouring wax into snow "mold." Resulting designs are as varied as snowflakes.

solidified completely, more wax, usually of a second color, is poured into the mold. Results can be surprising. Instead of filling the mold to the top, the second pour will run to the bottom of the mold and harden under the first, making its own design. This candle is not inverted, but used in the position in which it is formed. Usually some wax must be removed from the bottom to make it sit flat; use a hot knife and be careful not to break off delicate parts. Sometimes the second pour will go deeper than the wick and another must be inserted; use a heated icepick to make a tiny hole, place the new wick and pour melted wax around it.

It takes about an hour for wax to harden enough for removal from the snow. Be very careful when digging out the candle—parts may spread far from the original mold.

Snow characteristics will affect candles. Try molds made in new or soft snow, both packed and unpacked. Crusty or melting snow makes interesting but generally more predictably shaped candles. ★★★





# Yule tree— from tin cans

by Wayne C. Leckey

HOME AND SHOP EDITOR

You'll not only have the most dazzling yard decoration you ever saw, but you'll be helping out with ecology in rounding up the 101 tin cans required to make this 8-ft.-tall Christmas tree.

Serving as reflectors for 101 miniature tree lights, the one-gal. institutional-size cans appear as a pyramid cluster of 6-in.-ball ornaments when lights are turned on.

A brainchild of Oren A. Glatt of Abilene, Kans., the tree is the kind of entry which can easily cop first prize in any local lighting contest—it's that spectacular!

Good sources for the cans are school cafeterias and local restaurants. After washing the cans and removing the labels, drill two holes in the bottom of each—a  $\frac{1}{2}$ -in. hole in the center for a miniature tree bulb, and a  $\frac{3}{16}$ -in. hole for a  $\frac{1}{2}$ -in. wood screw. A swinging support for the can, such as the one shown in the photos on page 73, automatically centers the can on the drill press and makes the drilling go faster. A neater  $\frac{1}{2}$ -in. hole in thin sheet metal results when you start with a  $\frac{1}{8}$ -in. bit and work up to the final size with progressively larger bits. In each case, you should not ram the bit through, but drill slowly.

After all holes are drilled, 87 of the cans are sprayed green on the inside  $1\frac{1}{2}$ -in. or so down from the top. It's not too necessary to paint the outside of the cans although it will make the tree look better in the daytime, and, of course, prevent rusting. Finally, clear spray is applied to the remainder of the interior of the cans to add additional "sparkle." The same is done to the remaining 14 cans (the trunk of the tree) except they are painted red.

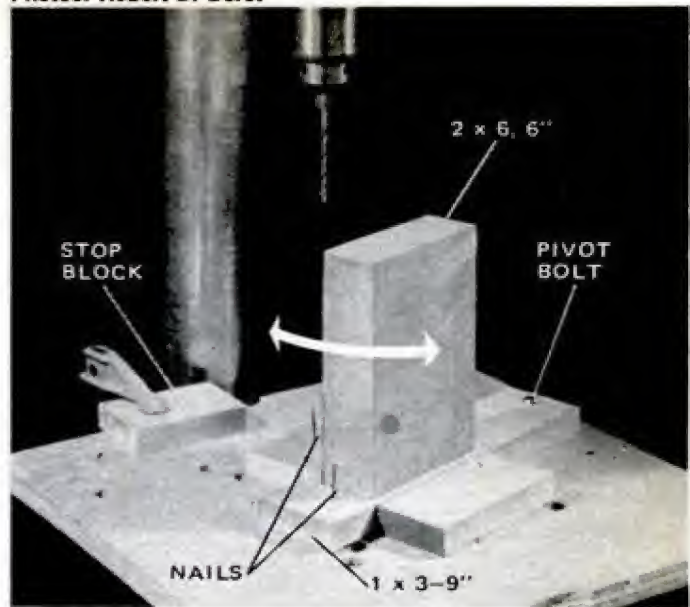
The cans are attached to a  $\frac{3}{4}$ -in.-plywood

*(Please turn to page 176)*

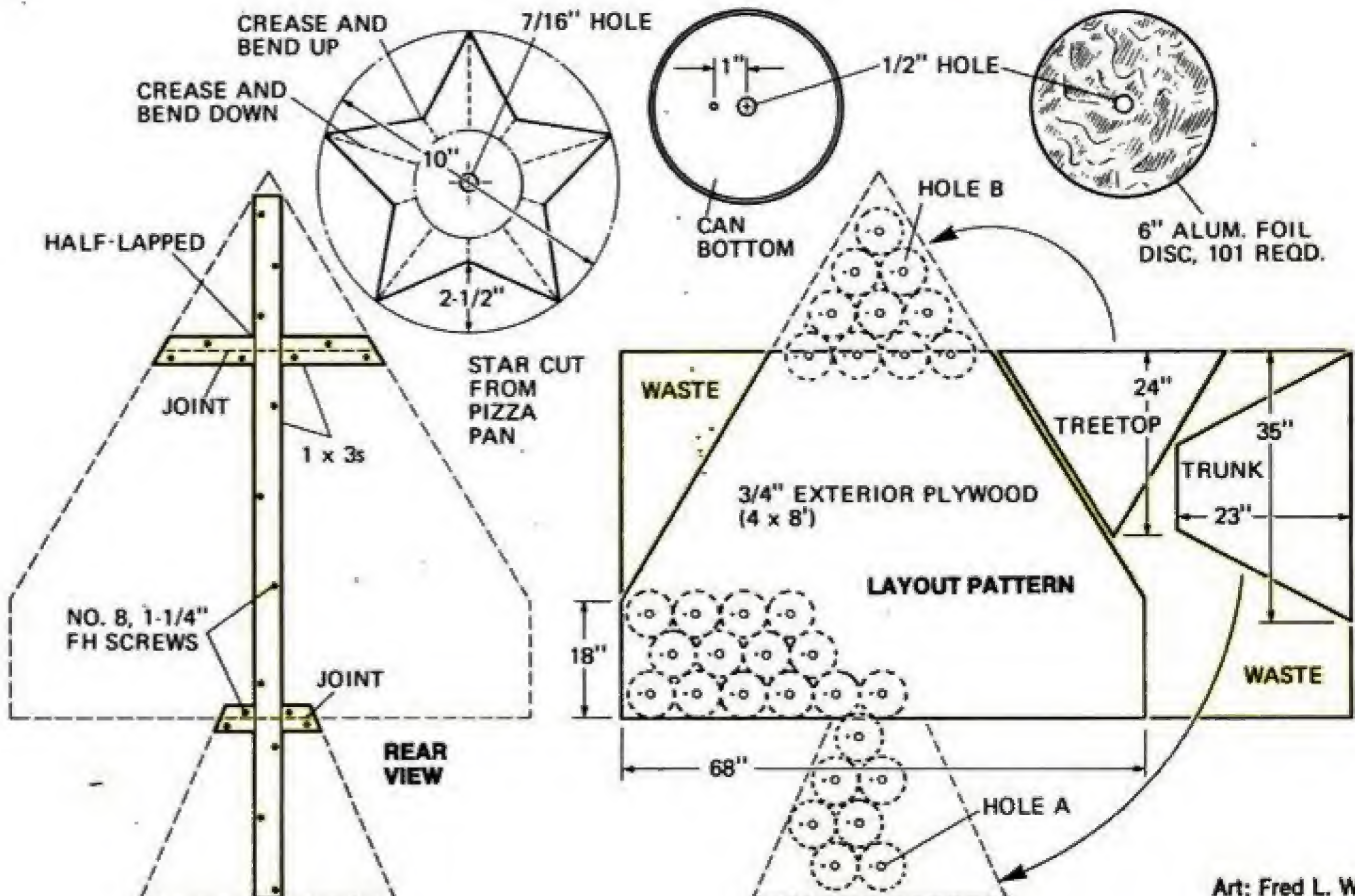
**Daytime look of tree (left)** is improved when plywood and cans are painted green. Prop holds tree upright.







Jig support for drilling holes in bottom of cans (above right) is improvised from scrap blocks and pivoted to wood drill-press table so jig can be swung out and tin can placed over top. Nails automatically center can on jig and stop block centers jig under drill for fast and accurate drilling. True holes result in the thin metal when  $\frac{1}{2}$ -in. holes are started with  $\frac{1}{8}$ -in. bit. Spray paint (right) is used to coat inside of cans  $1\frac{1}{2}$  in. down from rim. This is done primarily for looks. Drawings (below) show how three parts of tree are laid out on 4x8-ft. sheet of fir plywood and how 1x3 cleats are placed on back to hold these parts together. Star is cut from foil pizza pan.



Art: Fred L. Wolff



# New gear for the snow season

Cold weather clothes this coming winter are likely to look wet and colorful, feel warm, comfortable.

by Bill McKeown  
OUTDOORS EDITOR

Winter wear warmth for snowmobilers includes matching suits, some with a "wet look," like these from John Deere made to match the manufacturer's machines.

Winter outdoorsmen—whether enjoying the action or watching it—have a lot of extras going for them this year. Clothes and accessories that can keep you warm have turned on the off-season for sportsmen and spectators alike.

Much thanks goes to the snowmobile. Skiing helped develop light stretchable clothes and unbendable boots. But it was the snow-going machines that required the wind-resistant padded suits and boots that now keep out the cold when you're in the driver's seat, on the sidelines and in the stadium, out ice fishing, off mountain camping, or just while doing chores, hunting, or mushing through drifts.

Goose down, DuPont's Dacron Fiberfill II, PolarGuard fabric and Thermos Space Blankets are among innovations that insulate to keep body warmth in where it belongs. And for face, eye, ear, nose, finger and toe protection, there are new goggles, gloves, face masks, helmets, thermal wear, socks and survivor boots—some electrified.

For appearance, far-out colors and wet-looks will be brightening the black and white of snowscapes. But the big bonus is cool season warmth and comfort from outdoor gear to keep winter in its place. ★★







Matching new Polaris white and blue machines are red and blue, wet-or-dry-look one-piece suits or jacket and pants sets that are easier to remove.



Uvex Sound System from Garcia Ski & Tennis has goggles, earphones to hear downhill music, radio tips from instructor, belt pouch for receiver, tape.



Racing stripes are feature of Mercury's four snowmobile models and jackets of their two-piece suits. Take-off jackets make lodge warm-up stops easier.

Microlouv goggles, new from 3M and about \$15, have tiny horizontal louvers that don't show to viewer but shadow eyes, reduce fatigue from glare.



Formerly all-yellow Ski-Doos now are many colors from Bombardier. Even wider assortment of match or contrast drive and lounge suits are being offered.





# Old boats

Pleasure-boat buffs visit the new Shipyard Museum year-round at Clayton, N.Y., but crowd into this pleasant Thousand Island stretch of Canadian border on the St. Lawrence river in August for the only antique boat show afloat. Judges see their reflection in mirror coats of varnish and polished engines; spectators ashore and on the water watch ancient narrow-beamed beauties glide by at up to 40 mph. Keeping fine old St. Lawrence skiffs, plus rowing craft, canoes, guide boats, launches, runabouts and cruisers alive and well is becoming another art. ★★★

Antique outboards, left, are viewed by visitors, judges during annual display during in-the-water parade and contest for best restored craft. Classic ACF cruiser Vagabond, below, still used by Jim and Tony Lewis of Beaver Falls, N.Y., has 1930s date but modern look.

Photos: Lorraine McKeown



Shipyard Museum at Thousand Islands, Clayton, N.Y., is only collection specializing in antique and classic (pre-1940) power craft. Exhibits include old outboard motors, inboard steam, naphtha and gasoline engines; classic launches like three-cockpit Snark on trailer.



Fawn, a treasured 19-foot launch built sometime prior to 1888 in Skaneateles, N.Y., once was powered by a steam engine, now uses an old 3-hp Buffalo. Classic mahogany Wild Goose of 1915, shown at left, daily cruises her old Chrysler engine at 30 mph.



# New boats

**P**re-boat-show previews of the newest in pleasure craft indicate more outside styling and inside space. Bass boats are still growing in popularity, size, electronic gadgets and horsepower.

Runabouts are making room for more passengers, with opened-up foredecks, and should be even more seaworthy as new safety requirements for flotation, plaques for cargo weight and power recommendations go in effect. Stern steps make boarding easier for skiers or a man overboard. Boatmen are demanding smoother rides as they learn how a good hull should perform. ★★★

**High-style sportsters** in the '74 Glastron line, right, will be the CV-19 S/S, top, and the 18-foot CV-18 S/S. A stern swim platform is a feature of the 19 jet from the Glastron/Carlson division, while the CV-18 will have jet or stern-drive power, full cockpit handrails.



**Runabout speedster** with the additional open space of a foredeck cockpit is this model from Crestliner's updated line. New Ted Williams 14-foot Gamefisher bass boat from Sears, bottom, has optional controls available, with power up to 25 hp.



**Catamaran sailing** may be an ancient art, but it's showing modern popularity. Chrysler's new Musketeer, above, is 16½-foot day sailer designed by British champion cat sailor Rod Macalpine-Downie. Paceboat to windward is Chrysler C-486 cruiser, 23-foot hardtop.





# How to fix a gas clothes dryer

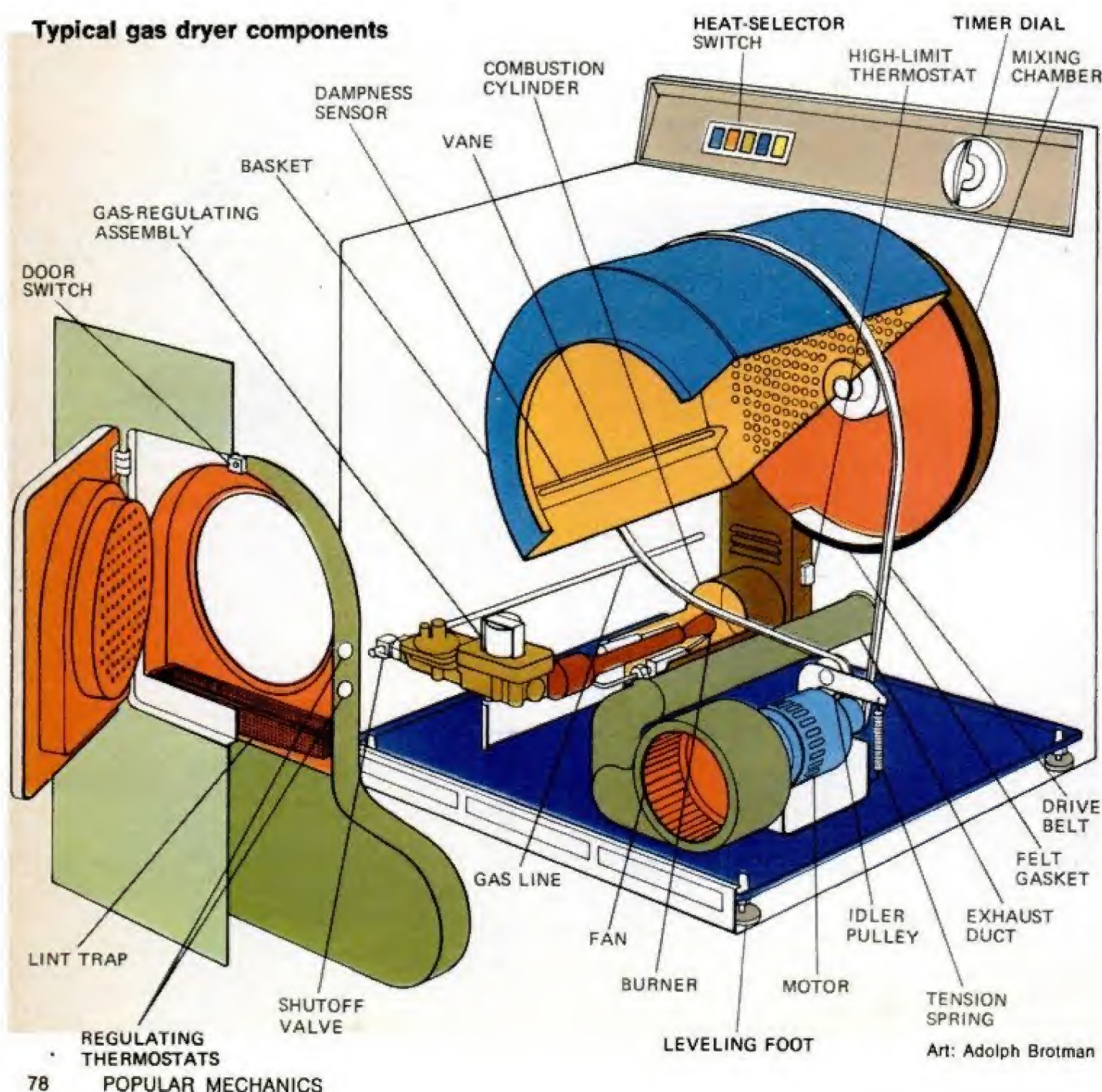
Data: Ed Franzese

A gas clothes dryer, like an electric dryer, is designed to remove moisture from damp clothes by passing hot air over and through them. In place of a simple heating element, a gas dryer has a burner with complex controls and safety devices. While controls and ignition systems vary from one manufacturer to another, there are few basic types and troubleshooting charts on the next five pages will tell you how to deal with the most common problems that may

arise. Gas problems more complicated than those covered in the charts should be handled only by a qualified serviceman.

Many electrical and mechanical functions of a gas dryer are the same as those of an electric model and many of its problems are handled the same way—these are also covered in the charts. But the electronic dampness sensors found on many newer gas and electric dryers are delicate devices best left to the serviceman. ★★★

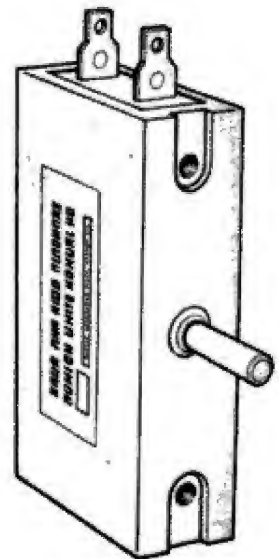
## Typical gas dryer components



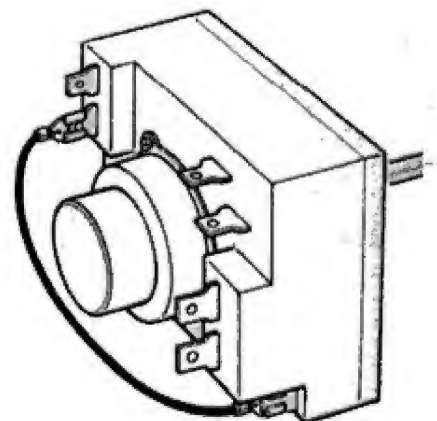


**Motor does not start**

POSSIBLE CAUSES	WHAT TO TRY
1. Fuse blown.	Replace fuse (or reset circuit breaker).
2. Door open.	Close door tightly.
3. Timer defective.	Check the line voltage at timer. Turn timer on and place 115-v. test lamp across its terminals. If you get a reading, it indicates open contacts. Replace contacts or timer.
4. Door switch defective.	Remove wires from the door switch, then place continuity tester across the switch terminals and press button. No reading indicates a defective switch. Replace.
5. Motor wiring loose or disconnected.	Tighten or reconnect loose or disconnected wires.
6. Centrifugal switch defective.	Refer to the manufacturer's schematic diagram for switch terminals on the motor; place continuity tester across terminals. If you get no reading, replace switch or motor.
7. Motor defective.	Direct-test motor with test jumper. If motor still fails to run, replace.

**DOOR SWITCH****Motor hums**

POSSIBLE CAUSES	WHAT TO TRY
1. Centrifugal switch in motor stuck.	Remove both motor and switch. Grease the shaft, clean the contacts and reassemble. If the switch still sticks, replace it.
2. Basket binding or idler wheel broken.	Check the basket while turning it by hand. Replace any worn or broken idler wheels. Check leveling of machine.
3. Motor defective.	Direct-test motor with test jumper. Replace motor if it fails to operate properly.

**TIMER****Motor runs, basket does not rotate**

POSSIBLE CAUSES	WHAT TO TRY
1. Broken belt.	Remove back of dryer and replace any broken belts you find.
2. Loose pulley.	Check setscrews in all pulleys. If pulleys are slipping on their shafts, realign them first and then tighten setscrews.
3. Tension spring broken.	Replace broken tension spring.
4. Basket binding or idler wheel broken.	Check the basket while turning it by hand. Replace any worn or broken idler wheels. Check leveling of machine.



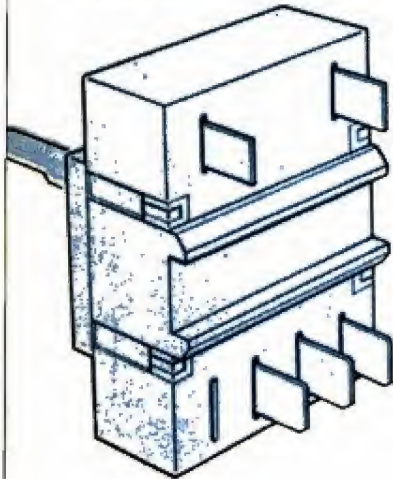
## Noisy operation

### POSSIBLE CAUSES

### WHAT TO TRY

- |                                    |  |
|------------------------------------|--|
| 1. Loose fan.                      | Retighten fan-blade setscrew on motor shaft.   |
| 2. Loose objects caught in basket. | Remove all loose objects from basket.  |
| 3. Loose motor pulley.             | Retighten motor-pulley setscrew.   |
| 4. Worn belt.                      | Replace any worn or frayed belts.  |
| 5. Basket binding.                 | Turn basket by hand to locate the point of binding. Check felt gaskets, wire harnesses and leveling of the unit.   |
| 6. Vibration.                      | Check for a loose fan blade, an out-of-balance fan blade, also for worn basket bearings and motor mounts. Tighten any loosened parts and replace worn parts. |

## TIMER



**Pattern of airflow** in most gas dryers is as shown below—air is mixed with hot flue products behind basket, sucked through it and through lint trap to fan; then it's forced out through exhaust duct and hose. Below, right, is the type of basket-drive system generally found in dryers that do not use the single-belt drive shown on page 78.

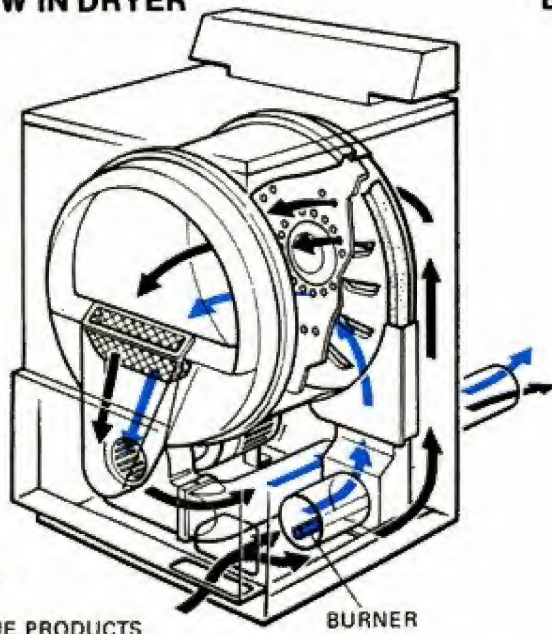
## Dryer does not shut off

### POSSIBLE CAUSES

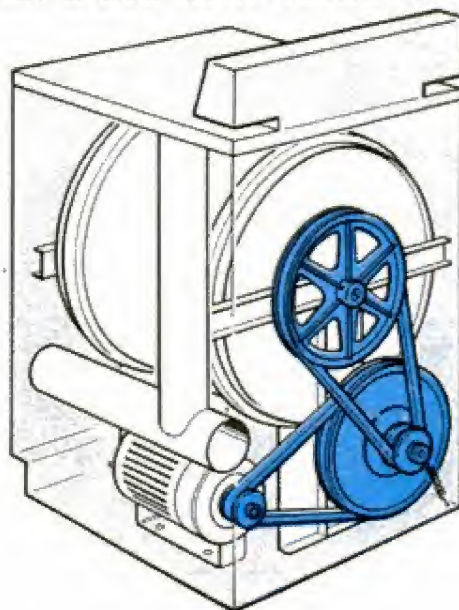
### WHAT TO TRY

- |                                    |   |
|------------------------------------|---|
| 1. Timer defective.                | Check for a stuck timer or welded contact points. Replace.  |
| 2. Door switch defective.          | Remove wires from the door-switch terminals; then place continuity tester across terminals. If there is a reading before the switch button is pressed, replace switch.                                |
| 3. Operating thermostat defective. | Check thermostat against the manufacturer's specifications with a thermometer in the exhaust duct. If defective, replace.   |
| 4. Motor grounded.                 | Remove wires from motor terminals. Touch one lead of the continuity tester to a terminal and the other lead to the motor housing. If you get a reading on the tester, the motor is grounded. Replace. |

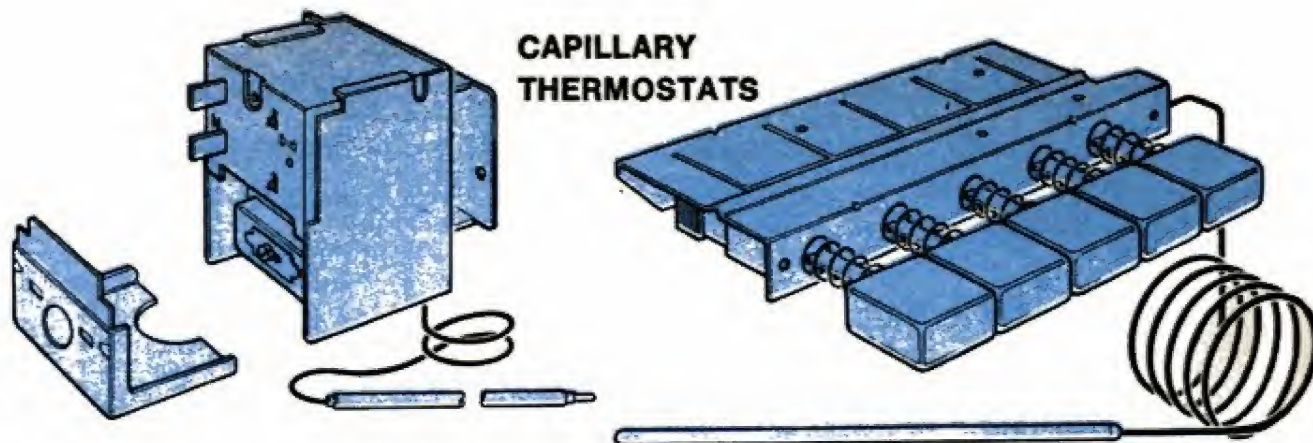
## AIRFLOW IN DRYER



## BASKET DRIVE WITH REDUCTION PULLEY



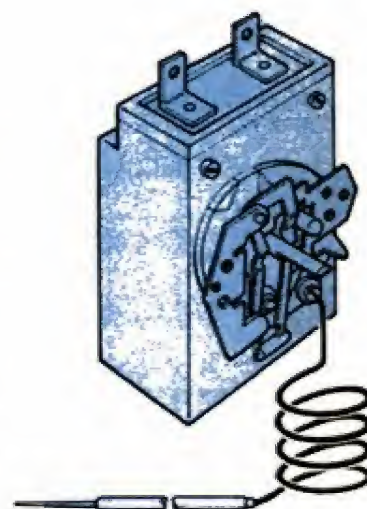




**CAPILLARY THERMOSTATS**

**Clothes dry slowly or not at all**

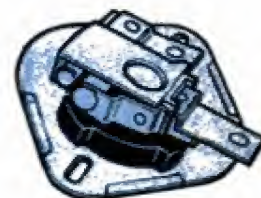
POSSIBLE CAUSES	WHAT TO TRY
1. Basket overloaded.	Check size of load. Refer to manufacturer's minimum and maximum standards.
2. Operating thermostat defective.	Check thermostat against the manufacturer's specifications with a thermostat in the exhaust duct. Replace thermostat if it does not operate at correct temperatures.
3. Lint trap clogged.	Clean lint trap thoroughly.
4. Exhaust hose clogged.	Clear exhaust hose.
5. Main burner orifice too small.	Check size of orifice (usually stamped on fitting) against manufacturer's specifications. Replace if incorrect.
6. Timer set too low.	Check owner's operating manual and increase the timer setting.
7. Ignition assembly defective.	Refer to following charts that cover pilot and ignition problems.



**Pilot will not light or goes out**

POSSIBLE CAUSES	WHAT TO TRY
1. Loose connections in thermocouple circuit.	Check thermocouple fittings and tightness of screws on terminal leads.
2. Vent pipe off fan housing; draft blows pilot out.	Check position of the vent pipe (exhaust duct). Reposition it if necessary and secure it with a retaining clip.
3. Pilot burner or orifice dirty.	Check and clean pilot burner and orifice. Do not ream orifice.
4. Filter clogged.	Clean or replace pilot line filter.
5. Thermocouple defective.	Check thermocouple voltage with pilot on. Reading should be between 10 and 18 millivolts. Check against manufacturer's specifications.
6. Magnetic (Baso) valve defective.	Check thermocouple voltage as above. If okay, replace Baso valve.
7. Low gas pressure.	Pressure after regulator should be 2 to 3 ounces per square inch, or show a 3½-in. water column in a U-tube manometer, with the main burner operating. Check with gas company if low.

**BIMETAL THERMOSTATS**



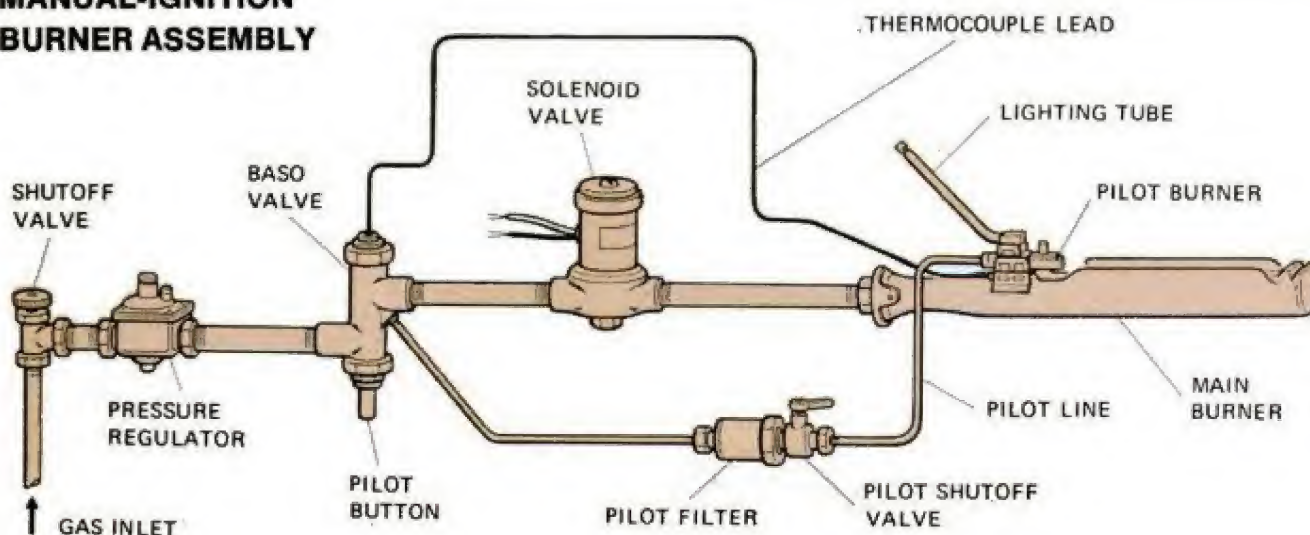


## Pilot burning high, low or erratically

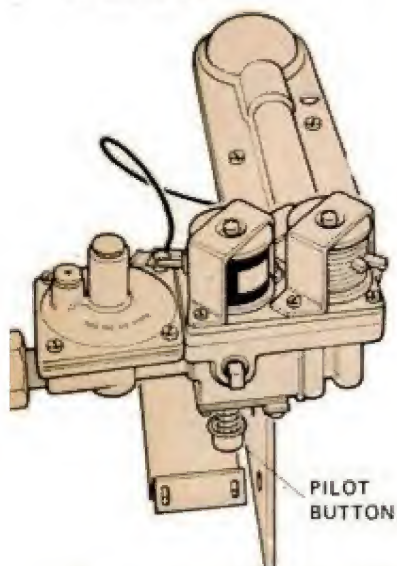
**Caution:** Be sure power is turned off before you handle components. Make all continuity tests with power off. When using a test lamp, keep power off while connecting and disconnecting the lamp. Use your manufacturer's manual to locate components, and use only replacement parts that meet his specifications.

POSSIBLE CAUSES	WHAT TO TRY
1. Orifice clogged.	Clean orifice—do not ream.
2. Pilot out of adjustment.	Adjust pilot by means of screw on Baso valve to raise or lower flame.
3. Orifice wrong size.	Check orifice size against the manufacturer's specifications. Replace if wrong.
4. Filter clogged.	Clean or replace pilot line filter.
5. Gas pressure too high or too low.	See "Low gas pressure" in preceding chart.
6. Yellow-tipped flame.	Open air shutter or use smaller orifice. Clean orifice—do not ream.
7. Orange flame.	Clean orifice, surrounding area—do not ream.

### MANUAL-IGNITION BURNER ASSEMBLY



### MANUAL-IGNITION BURNER



## Pilot lights; main burner does not light

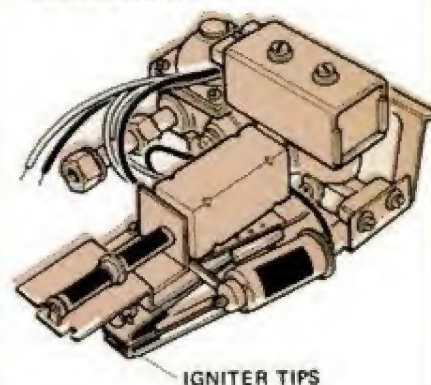
POSSIBLE CAUSES	WHAT TO TRY
1. Orifice plugged.	Clean main burner orifice.
2. Main solenoid coil defective.	Disconnect power and remove leads from solenoid coil. Place continuity tester across terminals. No reading indicates a defective or open solenoid. Replace.
3. Open circuit to main solenoid.	Disconnect power. Check continuity of circuit through pilot switch, door switch, thermostats and line fuse. Correct wherever circuit is open.
4. Timer defective.	Turn timer on. Check voltage at the solenoid with 115-v. test lamp. No voltage indicates a defective timer. Replace.
5. Valve closed.	Open valve in line to main burner.
6. Centrifugal switch in motor defective.	See "Centrifugal switch defective" in chart titled "Motor does not start" (page 79).



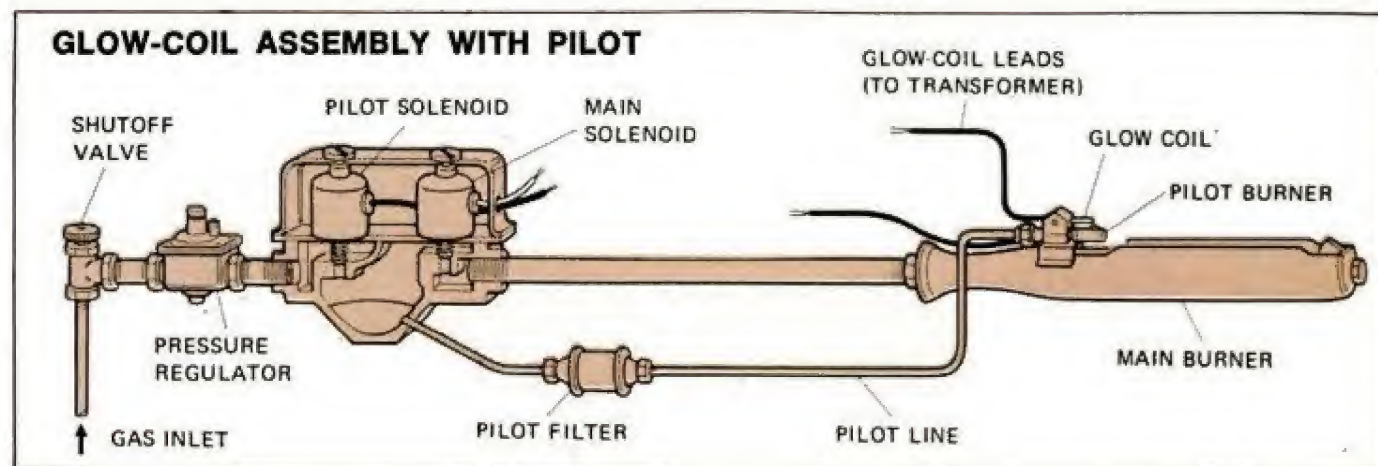
## Glow coil does not heat

POSSIBLE CAUSES	WHAT TO TRY
1. Broken or damaged coil.	Replace coil.
2. Leads broken or shorted to housing.	Replace broken leads; remove leads from shorted points. Check transformer secondary voltage.
3. Open circuit in transformer	Disconnect power and check transformer windings for continuity. If open, replace transformer.
4. Open circuit between timer and transformer.	Disconnect power; check continuity through warp-switch (bimetal) contacts, fuses, safety pilot contacts, timer contacts. Correct wherever open.

## ELECTRIC-IGNITION ASSEMBLY



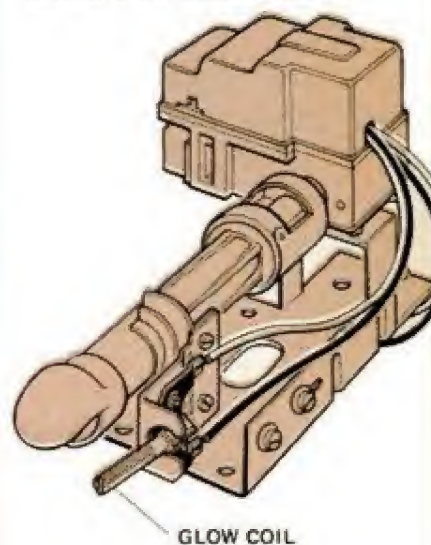
## GLOW-COIL ASSEMBLY WITH PILOT



## Glow coil heats; pilot does not ignite

POSSIBLE CAUSES	WHAT TO TRY
1. Orifice plugged.	Clean pilot orifice—do not ream.
2. Valve shut.	Open gas valve.
3. Pilot solenoid defective.	Disconnect power and solenoid leads. Test for continuity across terminals. No reading indicates a defective solenoid. Replace.
4. Vent pipe off fan housing causing draft across pilot.	Check position of the vent pipe (exhaust duct). Reposition it if necessary and secure it with a retaining clip.
5. Coil not hot enough.	Glow coil should be white hot. Refer to the following chart.

## GLOW-COIL BURNER ASSEMBLY

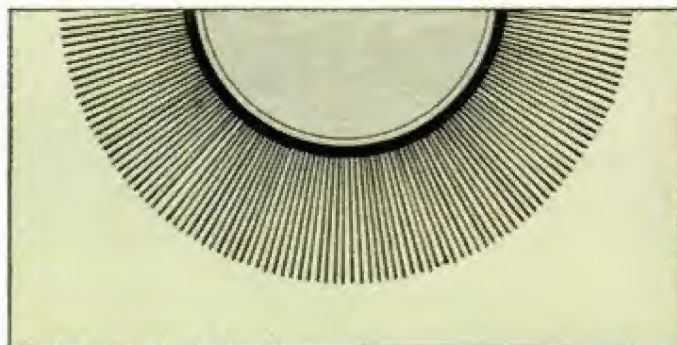


## Glow coil not hot enough

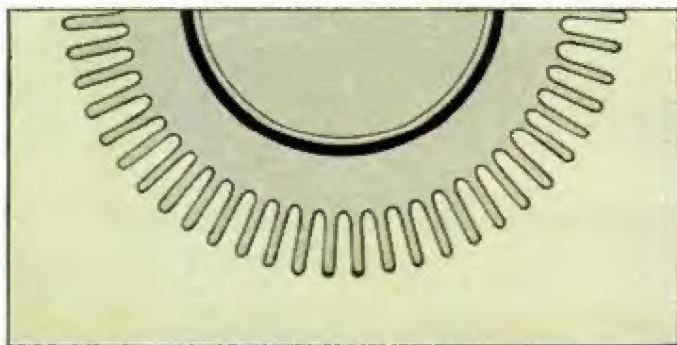
POSSIBLE CAUSES	WHAT TO TRY
1. Loose connection or short circuit.	Check and tighten all connections in the circuit. Reposition leads to avoid shorting them to bracket or housing.
2. Low voltage.	Check the line voltage, then check the voltage on both sides of the transformer against the manufacturer's specifications. If low, replace the transformer.



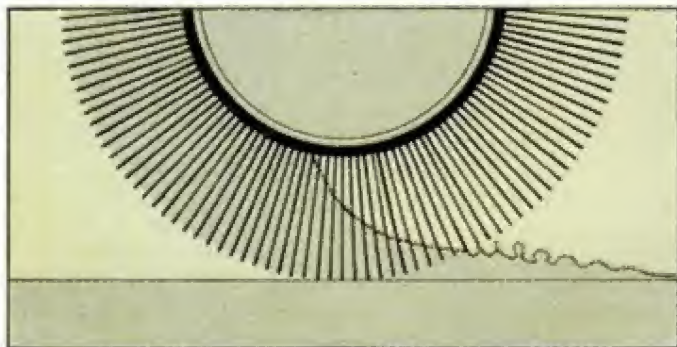
## CLIP-AND-SAVE KNOW-HOW



The number of fibers per square inch in a roller is a critical factor. If they are too dense, they will cut down the paint-holding capacity of the roller. They will also interfere with the roller's ability to meter out paint evenly on the surface.



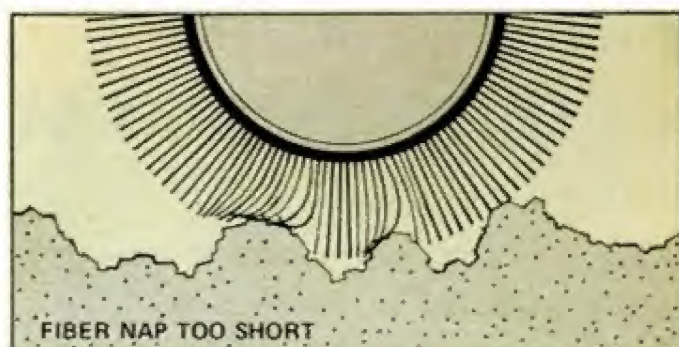
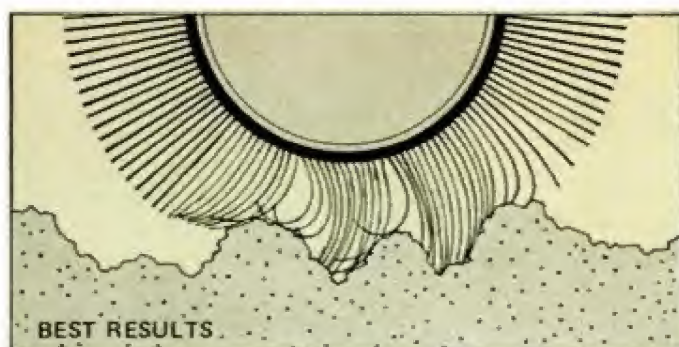
When too few fibers are distributed over a roller surface the result is just as bad as if the roller had too many fibers. Having an insufficient number of fibers, a roller lacks capacity to flow paint on the surface evenly. Result: a spotty paint job.



The proper number of fibers on a roller will distribute a uniform coat of paint that is relatively smooth as it goes on. Such a roller also carries a good paint load and cuts down the number of passes between the surface and the paint tray.

The typical paint applicators shown above make painting today easier than ever. Care should be taken to select roller covers that best suit the type of paint to be used. Basically, covers to be used for latex paints should not be made of rayon or lamb's wool (water causes softening and matting of the fibers). Oil and alkyd paints (thinned with mineral spirits or turpentine) will not affect most rollers. See the chart on the opposite page for the correct cover to use for most home paint jobs.





## Rough surface takes longer nap

Basically, the rougher the surface, the longer the nap length of roller cover should be. When fiber length is correctly matched to surface, a smooth, uniform coat without "show-through" is possible.

## Nobody needs a 'holiday'

If fiber length is too short for surface texture, roller cover will fail to reach bottoms of valleys in rough surface like stucco. Result: a paint job with show-throughs, commonly called holidays.

## GUIDE TO PAINT-ROLLER SELECTION

CODE FOR CHART BELOW	SIZE (Number)	CORE (1st letter)	FABRIC (2nd letter)	NAP LENGTH (3rd letter)
	9-9"	J-Jumbo	A-Lamb's wool	S-1/4" E-1"
	12-12"	F-Fiber	C-Carpet M-Mohair	I-1/2" X-1 1/4"
	18-18"	Phenolic	K-Textfab P-Pronel	L-3/4" U-1 1/2"

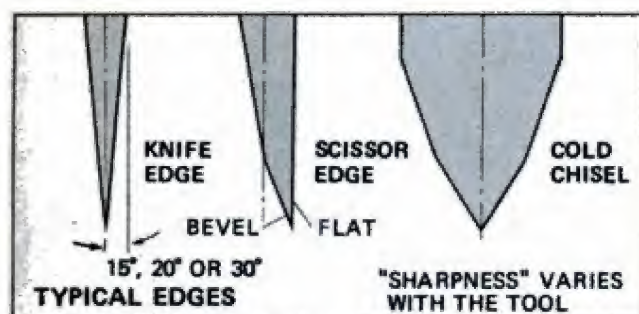
Chart information: EZ Painter Corp.

PAINT OR COATING MATERIAL	SMOOTH SURFACE <sup>1</sup>	SEMIROUGH <sup>2</sup>	ROUGH <sup>3</sup>	EXTRA ROUGH <sup>4</sup>
<b>Primers, Metal</b>				
Chlorinated rubber	9FP, 9JP	9FPI, 9JPI		
Epoxy	9FAS	9FA, 9JA		
Oleo-resinous	9FAS	9FA, 9JA		
Red lead or tinner's red	9FP, 9JP, 9FA, 9JA	9FPI, 9JPI, 9FA, 9JA		
Vinyl	9FAS	9FA, 9JA		
Wash coat	9FP, 9JJP	9FPI, 9JPI		
Wetting oil	9FAS	9FA, 9JA		
Zinc chromate	9FP, 9JP, 9FA, 9JA	9FPI, 9JPI, 9FA, 9JA		
<b>Primers, Wood</b>				
Oil and alkyd	9FP, 9FPS	9FPI, 9JPI, 9FA, 9JA		
Enamel undercoat	9FM, 9FPS, 9JM	9FPI, 9JPI		
<b>Primers, Masonry</b>				
Block fillers, oil or latex				9FPX, 9JPX
Silicone water repellent		9FA, 9JA	9FAL, 9JAL	9FAX, 9JAX
Sealer, clear		9FA, 9JA	9FAL, 9JAL	9FAE, 9JAE
Oleo-resinous		9FPI, 9JPI	9FPL, 9JPL	9FPE, 9JPE
<b>Primers, Wallboard</b>				
Emulsion or latex	9FP, 9JP	9FPI, 9JPI		
Oil and alkyd	9FP, 9JP, 9FA, 9JA	9FPI, 9JPI, 9FA, 9JA		
<b>Exterior Wood Finishes</b>				
Oil and alkyd paints	9FPS	9FPI, 9JPI, 9FA, 9JA	9FPL, 9JPL, 9FAL, 9JAL	
Latex house paints	9FPS	9FPI, 9JPI	9FPL, 9JPL	
Oil stains	9FA, 9JA	9FAL, 9JAL	9FAE, 9JAE	9FAX, 9JAX
Wood preservatives	9FA, 9JA	9FAL, 9JAL	9FAE, 9JAE	9FAX, 9JAX
<b>Floor Coatings</b>				
Alkyd	9FM, 9JM, 12JM, 18JM	9FP, 9LP, 12JP, 18JP		
Chlorinated rubber	9FM, 9JM, 12JM, 18JM	9FP, 9LP, 12JP, 18JP		
Epoxy	9FM, 9JM, 12JM, 18JM	9FA, 9JA, 12JA, 18JA		
Latex	9FM, 9JM, 12JM, 18JM	9FP, 9JP, 12JP, 18JP		
Sodium silicate (water glass)	9FM, 9JM, 12JM, 18JM	9FP, 9JP, 12JP, 18JP		
Urethane	9FPS, 9FM, 9JM, 12JM, 18JM	9FA, 9JA, 12JA, 18JA		
Seamless flooring system	9FPL for base, chip coats 9FPS for glaze coats			
<b>Interior Flat Finishes</b>				
Oil and alkyd flat	9FP, 9JP, 9FA, 9JA	9FPI, 9JPI, 9FA, 9JA	9FPL, 9JPL, 9FAL, 9JAL	9FPE, 9JPE, 9FAE, 9JAE
Latex	9FP, 9JP	9FPI, 9JPI	9FPL, 9JPL	9FPE, 9JPE
<b>Masonry Paints</b>				
Alkyd	9FP, 9JP, 9FA, 9JA	9FPI, 9JPI, 9FA, 9JA	9FPL, 9JPL, 9FAL, 9JAL	9FPE, 9JPE, 9FAE, 9JAE
Latex	9FP, 9JP	9FPI, 9JPI	9FPL, 9JPL	9FPE, 9JPE
Styrene-butadiene	9FP, 9JP	9FPI, 9JPI	9FPL, 9JPL	9FPX, 9JPX
<b>Stipple Paint</b>	9FC	9FC		
<b>Texture Paint</b>	9FK	9FK		
<b>Varnishes</b>				
Alkyd	9FPS, 9FM			
Phenolic	9FPS, 9FM			
Urethane	9FPS, 9FM			
<b>Wire-Fence Paints</b>		9FAL, 9JAL	9FAE, 9JAE	9JAU

Footnotes: 1-smooth wallboard, putty coat plaster, sanded wood, smooth metal; 2-sand-finished plaster or drywall, metal, poured concrete; 3-textured plaster, light stucco, wood shakes, filled block; 4-raw block, brick, heavy stucco.



# How to keep cutting edges sharp



## The how and why of sharpening

It won't take you long to discover that you'll get twofold benefits from keeping all cutting edges of your various tools sharp. First, your skills with chisels, knives, gouges and the like will increase because you will have better control over the tool. Second, since a dull cutting tool is far more dangerous to work with than a sharp one, you'll minimize the chance of unfortunate accidents. (A dull chisel, for example, forces you to do the work that the tool should be doing, by applying extra pressure. A chisel should cut effortlessly so there is no possibility of the tool skipping or jumping and nicking your free hand.)

Though most beginning workshoppers believe that efficient sharpening is beyond their skills, the opposite is true. Almost anyone can obtain, and keep, a sharp cutting edge rather than be forced to work with a ragged one—if he follows the basics listed on these pages.

Two sharpening rules of thumb you should always keep in mind:

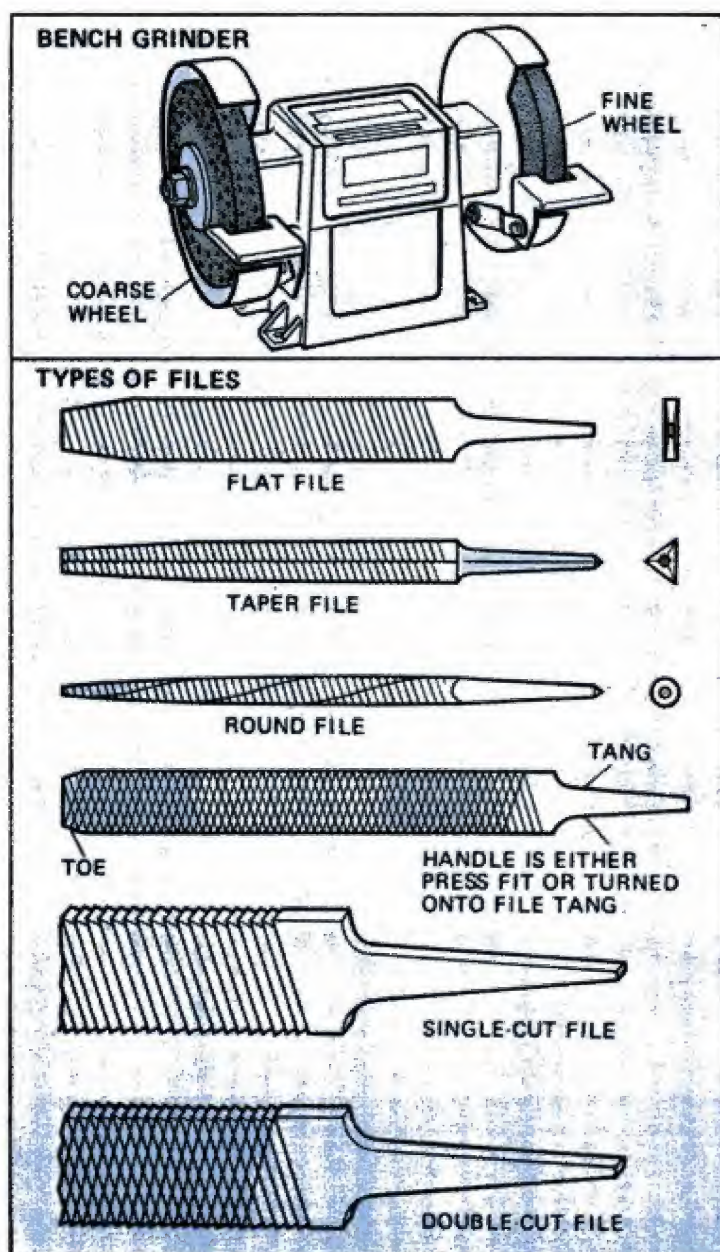
□ *Sharpen cutting tools regularly;* don't wait until they are dull and nicked because the cutting edge will then have to be reshaped on the grinding wheel.

□ *Maintain the tool's original cutting-edge shape* (see examples above) *when sharpening.* Various tools call for specific degrees of bevel and shape: These shapes (degree of bevel) have proven to be the best for the particular job for which the tool is intended.

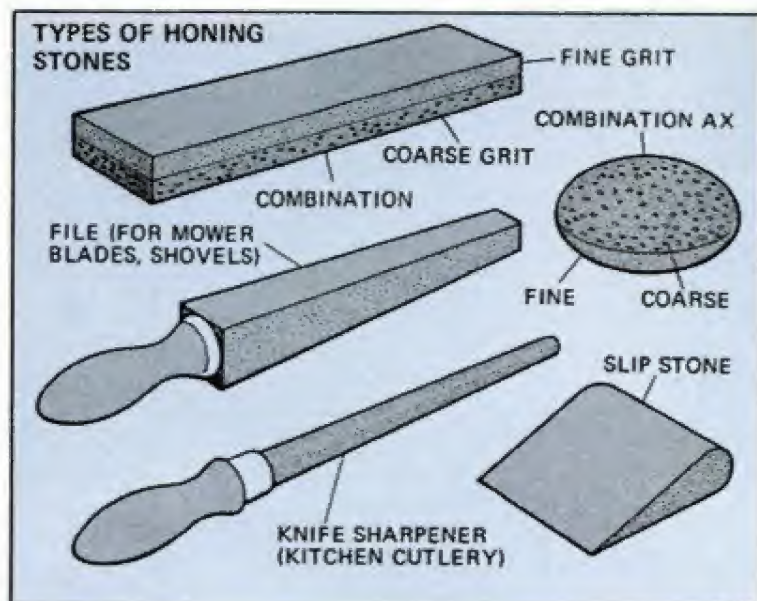
Any cutting tool that has been abused—lost its shape or nicked in its cutting edge—requires two steps for reconditioning: reshaping and sharpening. The reshaping may be done on a grinder, or with files if the tool is "soft" enough (of low carbon steel). To reshape, use coarse-grit grinding stones or files. The object of reshaping is to true a tool's edge, restore proper bevels and remove all nicks. Sharpness is *not* obtained with the coarser grits. Sharpening differs from reshaping in that only the edge requires work—removal of small particles of metal to achieve a razor edge.

## Grinding and grinding wheels

There are two principal types of grinding wheels: natural and man-made. The first are of fine grit and are used in water at relatively low speeds for sharpening and fine honing. To reshape an edge, switch to one of the man-made stones (available in fine, medium-fine, medium-coarse and, occasionally, in coarse). Though several types are made, best for all-around use are long-wearing bonded and vitrified aluminum-oxide abrasive wheels. Grinding generates heat; stop frequently and water-cool the tool so its temper is not drawn. If tool becomes bluish, it's too hot and has lost its hardness. After frequent use, metal particles may fill (load) the stone's pores. To dress a stone, use a steel wheel dresser; to dress natural stones, use a stone or a chunk of concrete.







### How-tos of honing

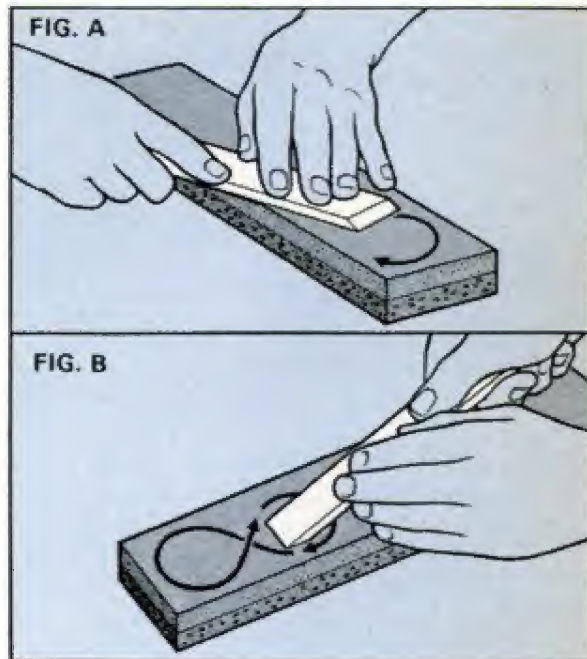
Like grinding wheels (natural and man-made), stones must be lubricated during use, either with water or a couple of drops of fine-grade machine oil. The lubricating agent is a matter of personal preference, but most pros prefer to use oil. Oilstones are probably the most commonly used honing stone; these are flat and may be of one grit throughout, but the combination type (see drawing above) is more practical to own.

The idea of honing is to feather the cutting edge as fine as possible. To do it, alternately stroke each side with progressively lighter pressure and finer grit abrasive. It is important that every stroke be delivered in the right direction and at the right pressure. Once you have achieved a feather edge, stop. Additional honing can be, in fact, damaging because there is good chance that you will change the tool's edge shape. The tool will be sharpened properly if, when passed lightly across your thumbnail, its edge delicately removes a scant amount of nail.

Honing stones should also be redressed occasionally and stored in a covered box.

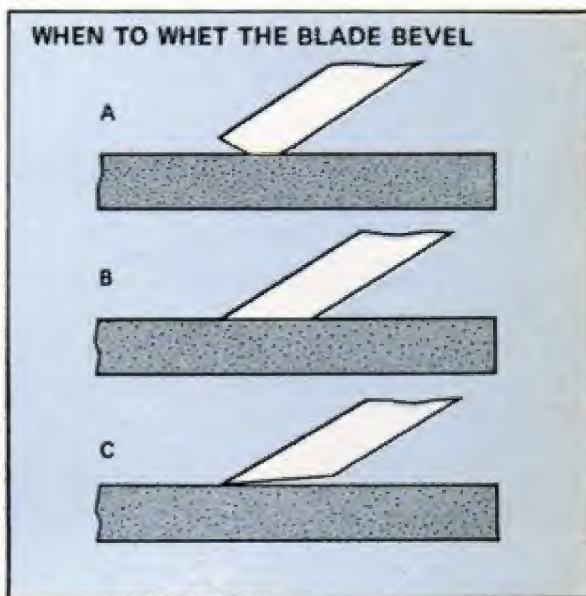
### Using files

Low-carbon cutting edges can be reshaped and sharpened with one of the files shown at left on facing page. The bottom edge of the cutter bar on a reel-type mower, for example, can be touched up using a flat metal-cutting file. (Never attempt to sharpen the reel blades unless you have the special equipment such sharpening requires.) When using files to sharpen a plane iron or chisel, support tool in vise so bevel edge is horizontal and cutting edge is facing away from you. File toward the edge. For straight-edge chisels, use mill files; for gouges, round files. Follow filing with a honing. ★★★



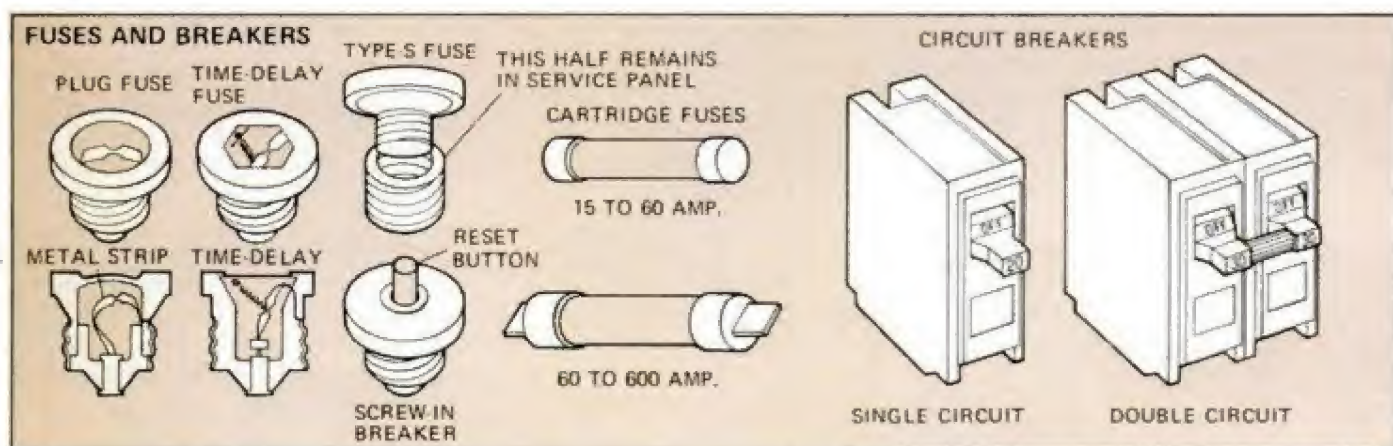
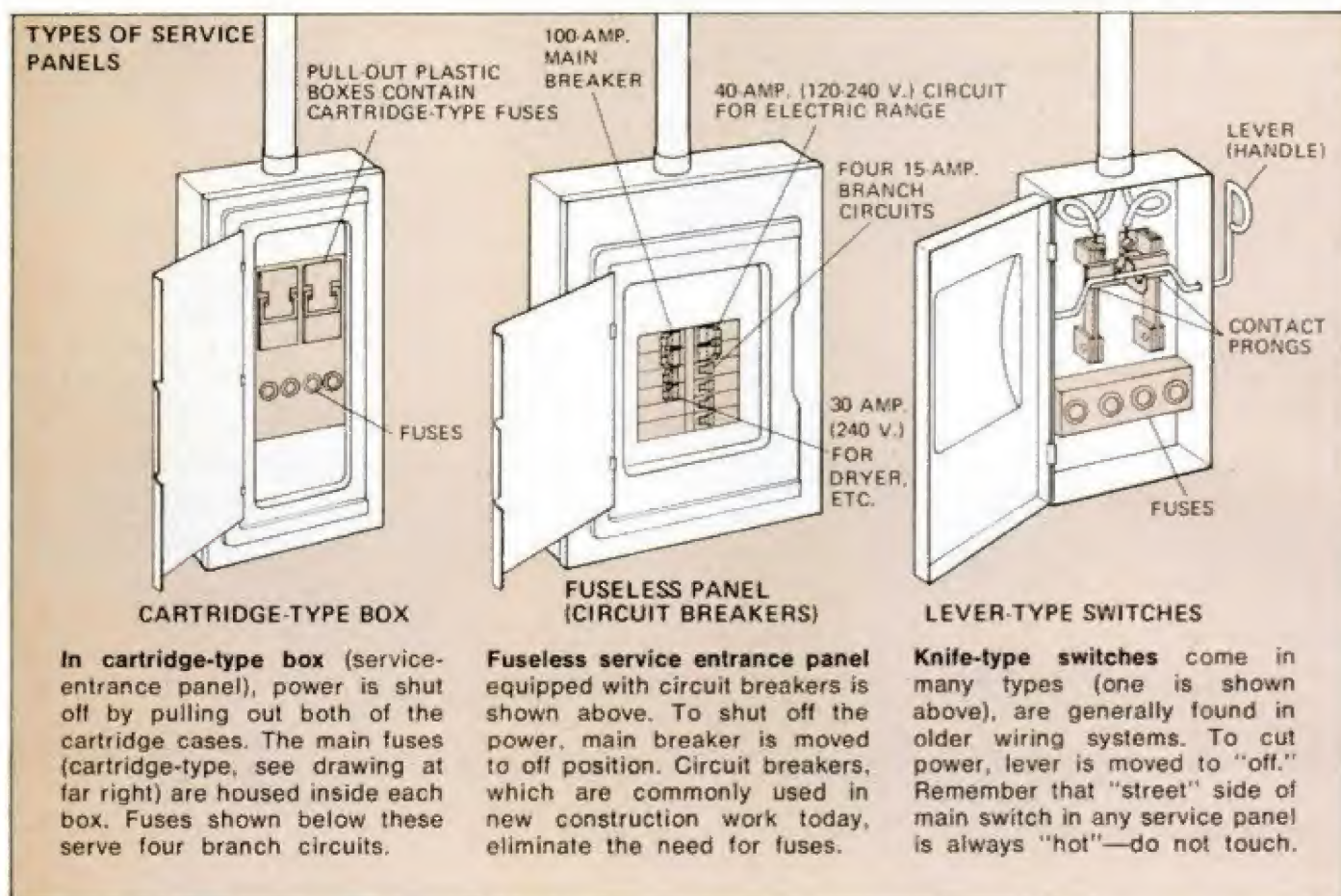
### Honing a chisel

To stone an edge without rounding it, use one hand to control the angle and the other to apply uniform downward pressure. In Fig. A above, burrs are removed using a circular motion. To hone bevel edge (Fig. B), keep wrists rigid and move the blade in a *continuous* figure-8 pattern. To maintain an edge which is started right, it must be occasionally whetted. In A (below), the blade needs attention all around; bevel must be taken all the way down as in B and then feathered to a razor edge as shown in C.





# How to handle an electrical emergency



## Fuses and breakers—built-in safety

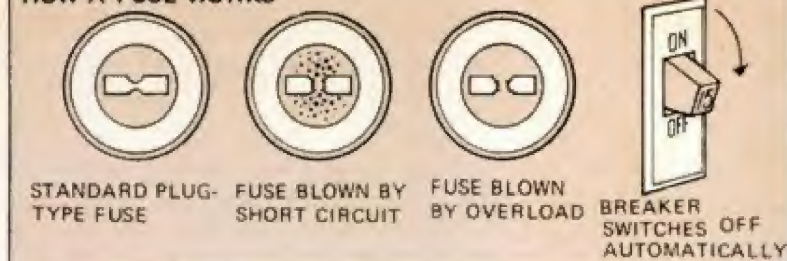
Electricity entering your service panel from the street is divided into what are called branch circuits that feed various outlets, switches and electrical equipment. Each circuit (cable) branching out from the service panel is connected to a fuse or circuit breaker, which, in turn, completes the connection with the electrical source (or main).

Fuses and breakers are designed to prevent fire hazard. If a line (circuit) becomes overloaded (hot)—whenever its capacity is exceeded by current

demand—the fuse controlling that line will "blow." This breaks the link with the main fuse—and the line goes dead. Several fuses are shown above. Cartridge and plug screw-in types must be replaced with new ones when they blow. Circuit-breakers do not blow, but "throw" a switch to off when overloaded—they are simply reset to the on position. Equipment on a branch circuit should be turned off prior to reactivating its circuit breaker or replacing its fuse.



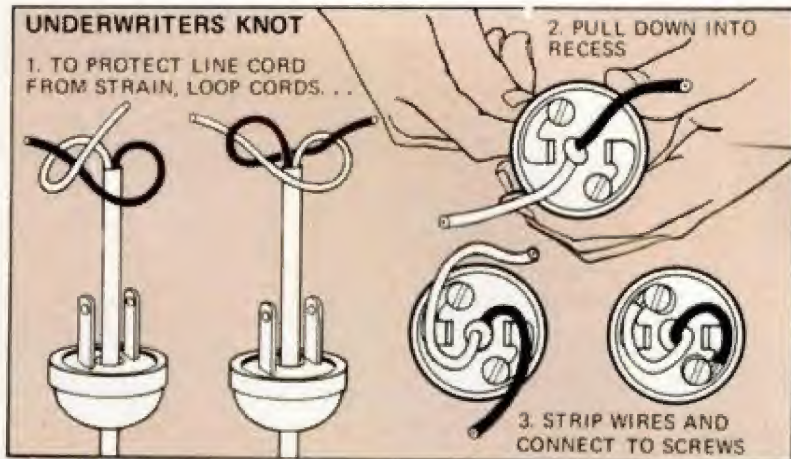
## HOW A FUSE WORKS



## How an ordinary fuse works

The standard plug-type fuse shown above is designed to protect an electrical circuit from overloading. Current passes through the metal strip running across the face of the fuse. If a circuit goes dead, a quick check of the service panel will let you know which fuse controls that circuit. If the fuse was blown by a short circuit, the metal strip would have been heated instantly to such high temperature that it vaporized, resulting in a discolored fuse window. If an overload was the cause, the strip would have overheated and melted, and broken at its weakest point—visible through a clear fuse window. In each case, the flow of current through the circuit was stopped and can be restored only by substitution of a new fuse. If you have a fuseless panel and a circuit goes dead, a breaker will have been tripped to "off." If problem is a short, an electrician should be called to trace the cause and make the repair.

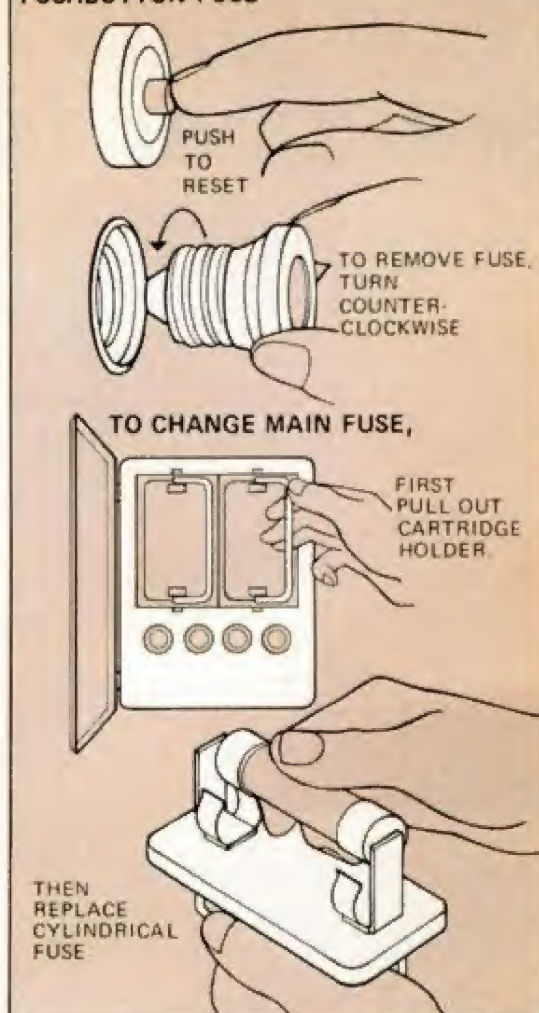
## UNDERWRITERS KNOT



## How to prevent cord pullout

Because most people mistakenly remove a line cord from a receptacle by pulling the cord instead of its plug, even molded plugs occasionally need replacing. To relieve the cord from such a strain, always make the new connection with an Underwriters knot as shown. If a cord is pulled from its plug, turn off the power for that circuit at the service panel before removing plug from the receptacle. Rewire cord with Underwriters knot to avoid recurrence of pullout.

## PUSHBUTTON FUSE





# New guns and gear for shooters

For young would-be marksmen and older sharpshooters as well, the selection is better than ever.

by Gary Gillespie



Many youngsters will be getting their first guns this month as Christmas gifts. Proper choice of gun and training of the young marksman are important. The appropriate selection doesn't have to be expensive, with the fancy elaborate engraving that delights an experienced collector, but it should be made with quality by a reputable manufacturer to insure safe and accurate performance.

For more experienced outdoorsmen, there is a tremendous variety of items they need, or think they need. To select a gift, you should begin with knowledge of the individual's specialty—range, benchrest, trapshooting, skeet, duck, deer or varmint hunting among others. Then, two sources of advice are available: your local sporting goods store or section of a department store, plus your reading.

At a well-established store, an experienced clerk can give good advice about arms, ammo and accessories. Taking along an expert friend is also worthwhile. One word of caution: Hunters and target shooters develop some very specific preferences, so you should know about his favorite makes and models, specifics of gauge and choke for shotguns and caliber for rifles, or else rely on a gift certificate. Shop early; a dealer can usually order exactly what you want if he has the time.

Second source for information and equip-

**El Dorado BB gun**, \$26, is new to Sears store and catalog line. Tested here by marksman Vinnie Shaw, it has look and feel of larger standard-size rifle.

## Gift selections for shooters of all ages

First gun for Jimmy (7): Daisy 102 Cub BB.

Training rifle for Bobby (10): Remington Model 580 Boy's Rifle with shortened stock.

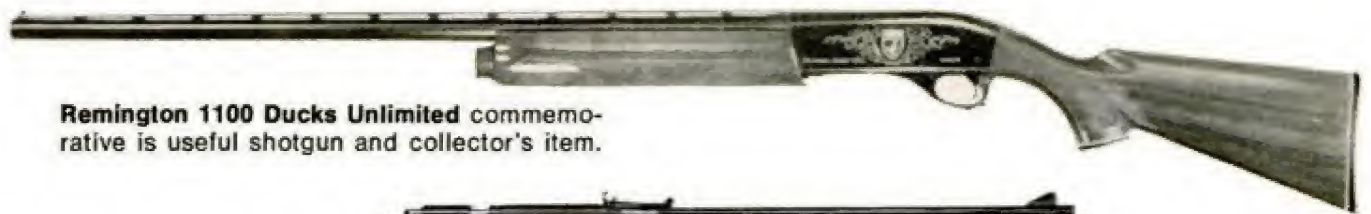
Introductory skeet gun for Jill (13) and Mom: Remington 1100 28-gauge skeet gun.

Indoor practice handgun (teens and adults): Crosman Mark I pellet pistol.

Team competition for Bill (15): Savage/Anschutz 64 match rifle.

All-around plinker for summer cabin time:

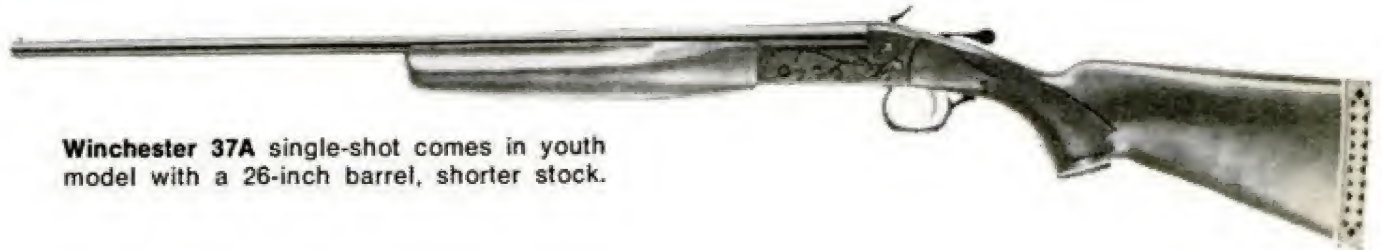




**Remington 1100 Ducks Unlimited** commemorative is useful shotgun and collector's item.



**Sheridan Blue Streak**, a \$48.25 pellet pneumatic, has sharpshooting accuracy.



**Winchester 37A** single-shot comes in youth model with a 26-inch barrel, shorter stock.



**Shotguns** make versatile gifts. Crosman CO<sub>2</sub> skeet set (right) includes trap with foot release, Trapmaster gas-powered shotgun, targets, shells. Hand-engraved receiver (far right) is feature of new imported over/under from Sears at less than \$200. Mauser-Bauer's Italian Model 610 skeet gun (below) with .12, .20, .28 and .410 Purbaugh Tubes for the dedicated skeet competitor, is about \$1300.





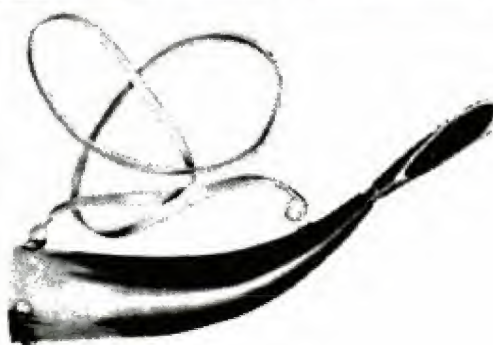
## New arms range from BB plinkers to big-game rifles



Old-time look for a rim-fire rifle, the .22 Ithaca Model 72 Saddlegun lever-action is \$80.



Muzzle loader like \$175 Hawken Hurricane from Navy Arms is for hunters, collectors.



Powder horn, \$6.55 from Numrich Arms is another favored item for black-powder man.



Deer rifle with Old West look, the Mossberg Model 472 lever action is \$100 6-shot 30-30.

ment are the pages of a magazine such as *PM* plus the excellent mail-order catalogs specializing in equipment for outdoorsmen. A list of some of the best-known houses are on the last page of this article. You can order from them while sitting at home.

*Air guns* can be a source of fun for the entire family, youngsters and adults alike. An indoor shooting range, where you use CO<sub>2</sub> or pump-up air guns, is quiet and requires little space in a basement or garage. It can provide hours of enjoyment as well as good safety and marksmanship training, plus sharper eyes and steadier hands for the bigger guns used afield.

Daisy has a complete BB Gun Range that includes four Model 99 Daisy Champion BB guns, 6000 rounds of BB shot, 400 paper targets and two BB backstop target holders—all for \$40. Crosman and Winchester also have a wide selection of pneumatic rifles

and pistols including highly sophisticated target types. Crosman offers a complete CO<sub>2</sub>-powered skeet kit with shotgun, trap, targets and reloadable shells for less than \$90. One of the most versatile indoor-outdoor pellet guns is the Sheridan "Blue Streak" with adjustable power—enough for outdoor hunting of small pests, and less than \$50. Benjamin is another famous quality manufacturer.

*Rim-fire .22-caliber rifles* are a step up the ladder for young family marksmen. Two new high-quality lever action models with the flair of the Old West are the Ithaca Model '72 Saddlegun for \$80 and the Winchester Model 9422 for about \$100. For less experienced beginners, don't overlook the many single-shot bolt action .22s at economy prices.

*Gun collector gift?* How about a commemorative that can combine distinctive

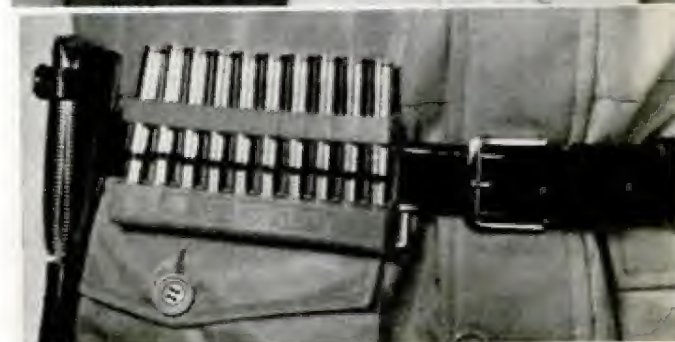


appearance, usefulness afield and growing collector value. Two recent issues of note are the Harrington & Richardson 1873 Springfield Commemorative Rifle with trapdoor single-shot action in 45-70 cal., and the Remington Model 1100 shotgun in a special Ducks Unlimited version.

*Left-hander in the family?* For years, southpaw shooters had to make do with guns made for the right-handed majority. No more. Now there are "lefty" versions of the Savage Model 110 or Remington Model 700 bolt-action rifles, or Remington Model 1100 or 870 pump-action shotguns and Model 581 bolt-action rim-fire rifle.

Shooters' extras certainly include clothing. Outdoorsmen don't enjoy getting wet or cold anymore than anyone else. Nothing beats expensive goose down, but you can save money by wearing a down underjacket like Eddie Bauer's \$32 Trail Shirt under less expensive outer wear. Pick footwear like Bean's famous rubber-leather boots for warm, dry feet. Hunting binoculars, spotting scopes, shooting glasses, rangefinders and assorted camping gear are also recommended items.

Books always make the off-season seem shorter. Recommended new volumes include *New England Grouse Shooting*, latest edition of a classic; *Gone for the Day*, a treasury of outdoor lore that's only \$2 by mail from the Pennsylvania Game Commission, Harrisburg, Pa. 17120; *Wild Game Cookbook* and *The Practical Hunter's Dog Book*, timely gifts; for the weathered-in shooter, sample *A Hunter's Fireside Book*. ★★



### Gear and equipment catalogs

Eddie Bauer, 1737 Airport Way South,  
Seattle, Wash. 98134.  
L. L. Bean Inc., Freeport, Me. 04032.  
Browning Arms, Rt. 1, Morgan, Utah 84050.  
Gander Mountain Inc., Box 248, Wilmot, Wis. 53192.  
Herter's Inc., RR 1, Waseca, Minn. 56093.  
Montgomery Ward (available at local retail stores).  
The Orvis Co., Manchester, Vt. 05254.  
Parker Distributors, 40 Industrial Place,  
New Rochelle, N.Y. 10805.  
Recreational Equipment Co., 1525 11th Ave.  
Seattle, Wash. 98122.  
Sears, Roebuck (available at local retail stores).  
Norm Thompson, 1805 N.W. Thurman St.  
Portland, Ore. 97209.

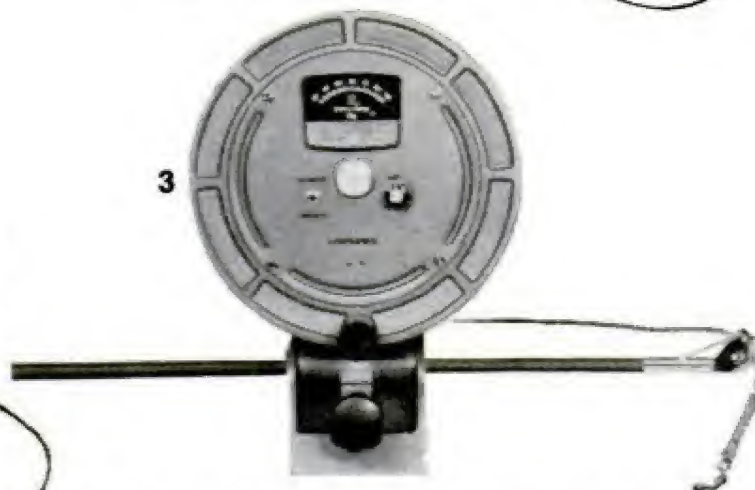
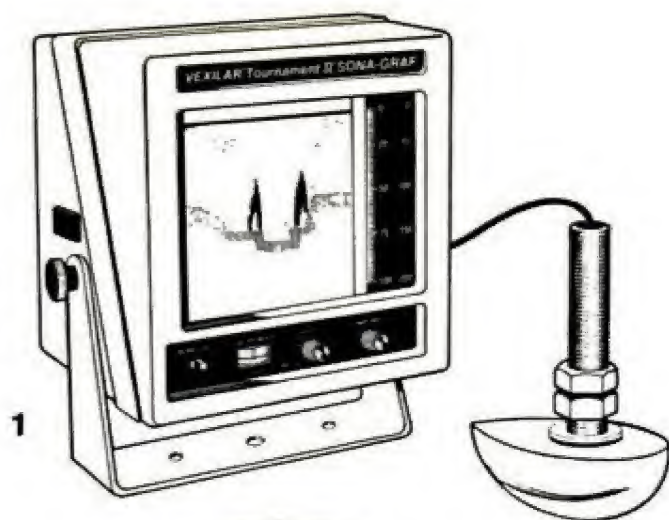
**Accessories make good gifts** for the hunter. A Thermos Space Blanket (top) can help ward off cold and rain in deer stand or duck blind while Rangematic distance finder shows true distances. L.L. Bean 7-inch Lounger Boots and Orvis "chamois cloth" shirts are outdoor favorites. Federal's new Cartridge Carrier fits belt.



# New meters for finding fish

Electronics now can note a lunker's favorite depth, bottom, temperature, light level and even oxygen supply.

by Bill McKeown  
OUTDOORS EDITOR



1. Vexilar's new Tournament II Sona/Graf 510 is now reported sensitive enough to indicate microorganism concentrations at thermocline or deep scattering layer, plus fish, making other measurements unnecessary.
2. Waller Fish Hawk 550 can give digital readings of oxygen ratio in the water, temperature, light density and depth at any probe sounding to 100 feet.
3. Lowrance LTG-200 Fish-N-Temp Rig, latest addition to Fish Lo-K-Tor line, is self-contained deep trolling system that also measures temperatures to 200 feet.

New fish-finding gadgets have gotten so sophisticated they now do everything except lower a questionnaire to ask lunkers what they'd like for lunch. Gone are the days when an angler measured the water depth with a sinker on a string, then dangled a worm or floated a fly—and hoped.

In 1924 Raytheon started marketing its famous Fathometer with electronic reading of distance from boat to bottom. (Since the sinking of the *Titanic* Raytheon had been trying to develop an iceberg warning device but found the echoes coming back showed where the bottom was instead.) Today's dedicated fishermen are familiar with the well-known Lowrance Fish Lo-K-Tor and similar small sonar sounders. These show bottom contour depths plus fish concentrations in between by neon flashes on the dial.

Last year Bass-Ox, Inc., of Dallas introduced a hand-held meter to measure the depths where oxygen in the water is from five to 13 parts per million, the content that fish prefer. A new model, Sentry II, reads underwater temperatures as well.

Garcia and others have now developed oxygen-ratio meters for 1974 fishermen, and the most elaborate is likely to be Waller's forthcoming Model 550 Fish Hawk. For about \$210 this one will give a digital depth reading as a probe is lowered that sends back oxygen, light density and temperature readings. Select from its front panel the kind of fish you want and its favorite temperature range, lower the probe to find the depth of that temperature, verify adequate oxygen content and then read the light density measurement to see which color lure



4



5



6



7



8



9



11



10



4. Garcia is introducing new O.T.P.-8500 Oxygen-Temperature Probe to locate optimum conditions.

5. Ray Jefferson Beeper 6010 shows bottom structure, fish; sounds alarm if fish or obstruction below.

6. Riviera Temptroll 1300 holds lure at selected depth to 200 feet while giving temperature readout.

7. Fishmaster Products Scuba Eye is diver's meter to show fish, caves, bottom distance, surface boats.

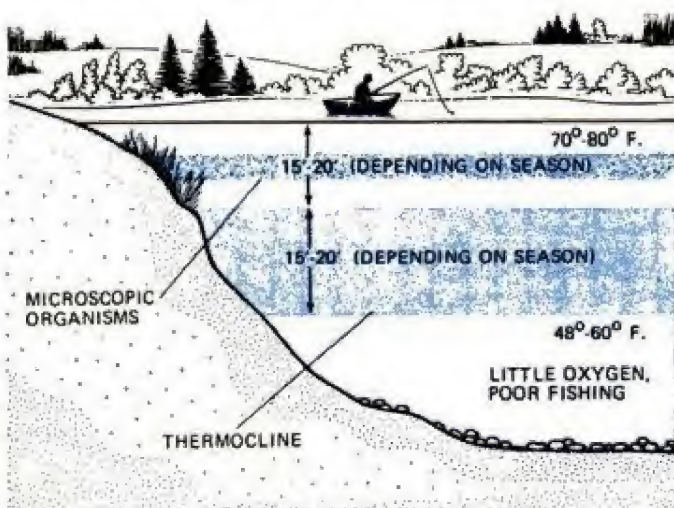
8. Waller Fish 600, \$60, is hand-held depth finder.

9. Lowrance Flasher-Graph LRG 600 shows bottom and fish on printout recorder or dial light.

10. Sea Deep Sounder/Locator, \$160, gives straight-line bottom, fish readings to 25, 50, or 200 feet.

11. Depth-O-Lite DL-30 at \$35 from Fishmaster indicates percentage of light penetration.

## THERMAL LAYERS IN A TYPICAL LAKE



Thermocline varies with water depth, but rapid drop of temperature usually indicates poor oxygen and fishing.

brightness will look most enticing down there!

A different approach, at \$399, is Vexilar's new Tournament II Sona Graf Model 510. With both vertical flasher in 100 and 200-foot ranges plus a straight-line chart recording graph, the instrument is reported to be so sensitive it can register not only individual fish but also, under optimum conditions, the microorganisms that form a layer above the thermocline at the major breaking point of the temperature pattern. They also react to light penetration, and oxygen so that these individual readings may not be necessary. This new Vexilar and other models have tested out at boat speeds above 40 mph.

Soon scientists may be able to out-think fish. Now if they can only persuade the fish to bite!

★★★



# For that needed energy: Pour on the coal!

Our gas and oil reserves are running out. Nuclear power is slow in developing. But coal is still there for the taking.

---

by M.F. Holbein

**The Geysers** produces electrical power for some northern California communities. It is the nation's only powerplant that uses natural steam to turn its generators.

Whether you call it a pinch, crunch or crisis, the fact is that we're running out of the stuff that makes everything go: jets in the sky, industrial machines, your auto, the furnace in your home, the toaster on the breakfast table. They all take their large or small bite out of the energy pie.

The average American is the world's greatest consumer of energy, according to statisticians at the Department of the Interior's Office of Coal Research. They figure it this way: Divide the total energy used in the United States on a per capita basis and you get 390 million B.T.U.s (British thermal units) consumed annually per person. (The energy involved equals 15 tons of coal.)

In contrast, the average Briton "consumes" 170 million B.T.U.s annually; the West German, 140 million, and the Brazilian only about 20 million.

Basic energy sources being tapped today include the fossil fuels—oil, coal and natural gas—and several of lesser importance. These include hydropower, nuclear power (uranium) and geothermal energy.

Natural gas, cleanest of fuels, is running out fast. If we don't find new reserves within the United States, we could burn up what we have in only 12 years. That's the estimate of Philip N. Ross, manager of





power systems planning at Westinghouse Electric Corp. Natural gas makes up only 3 percent of our energy supply but accounts for 32 percent of our use.

Mr. Ross also contends that the United States would be out of oil by 1995 if forced to depend solely on her domestic supplies. By importing oil, he says, we can extend the oil-burning age an additional 25 years. Then the entire world will be out of oil. At current usage rates, which are bound to rise, the world's oil will be totally consumed by the year 2021.

Not since 1967 has the United States been able to get along solely on the oil within her borders. Today, we import 24 percent of our oil. It's estimated that by 1985 our energy needs will be double those of 1970. By then, according to the Department of the Interior, we may have to import as much as 65 percent. That's the kind of thing calculated to give military men the shudders.

Some power experts say we might as well write off oil and turn to coal—the ancient fuel that's earned such a dirty name.

"We should place essentially no dependence on oil and natural gas in the long run," says Philip Ross. "Coal I foresee as being an increasingly precious commodity. Through its synthesis into petroleum and gaseous forms, it must furnish the needs of



Since the Department of the Interior has a wide responsibility in the energy area, PM submitted some key questions to Interior Secretary Rogers C. B. Morton. The questions and his answers appear below:

**In the immediate years ahead will the energy pinch get worse than it is now?**

In the near term, yes. The reason quite simply is that our domestic supply capacity from natural gas, oil, and refinery production has failed to match the increases in energy consumption.

**Do you foresee a time, then, when gasoline, natural gas, or electricity will be rationed to the consumer?**

It's possible, but I certainly don't see it in the near term. What the government will try to do, however, is to see that shortages, when they do occur, are shared equitably.

**How much of a contribution will the Trans-Alaskan Pipeline make to meeting our national energy needs?**

If we can start construction this year, the first oil from Alaska's North Slope will arrive by 1976 or 1977, and at full production it will bring 2-million barrels a day to the lower 48. That's equal to about a third of this year's oil imports.

**Do we know the potential value of oil and gas deposits on the continental shelf off the East Coast?**

Not really, because no one has actually undertaken drilling operations. The Geological Survey and private industry, however, have made some rough estimates based on surface core samples. These estimates suggest there are probably significant deposits there.

**What kind of a contribution can energy conservation make in meeting America's energy needs?**

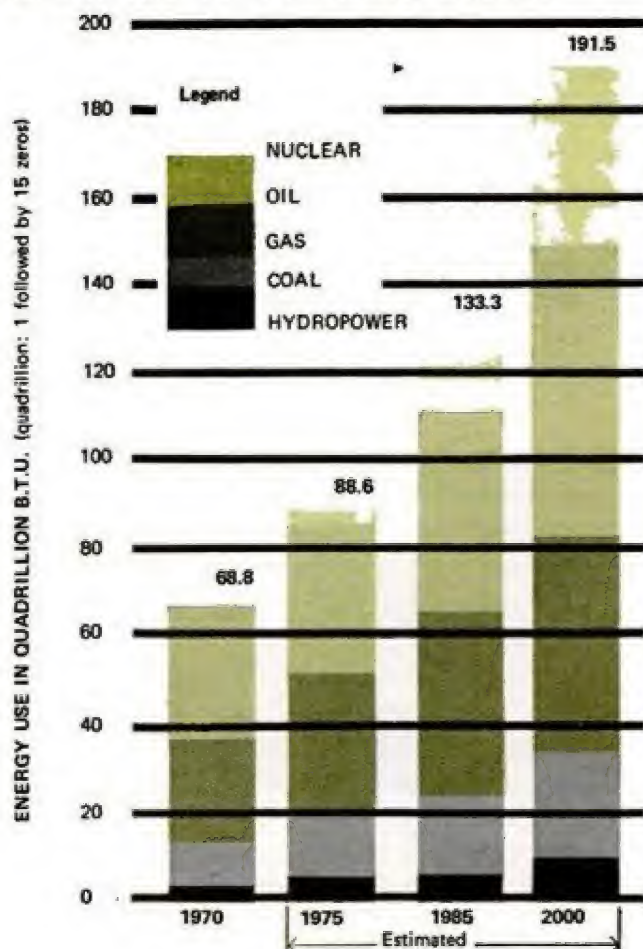
Simply increasing our energy supply is not enough. Energy conservation—and I mean reducing our total energy usage by only about 7 percent—must become a national habit.

**What about other new energy technologies?**

We are still sorting out the dimensions of oil shale and geothermal leasing programs on the federal lands. If we can minimize the environmental impacts and refine the technical advances we have made in these areas, there is no reason why both can't absorb a greater portion of the market by the end of the decade. That also applies to the breeder reactor.

Wide-scale applications of solar and fusion technology, however, are still many years in the future.

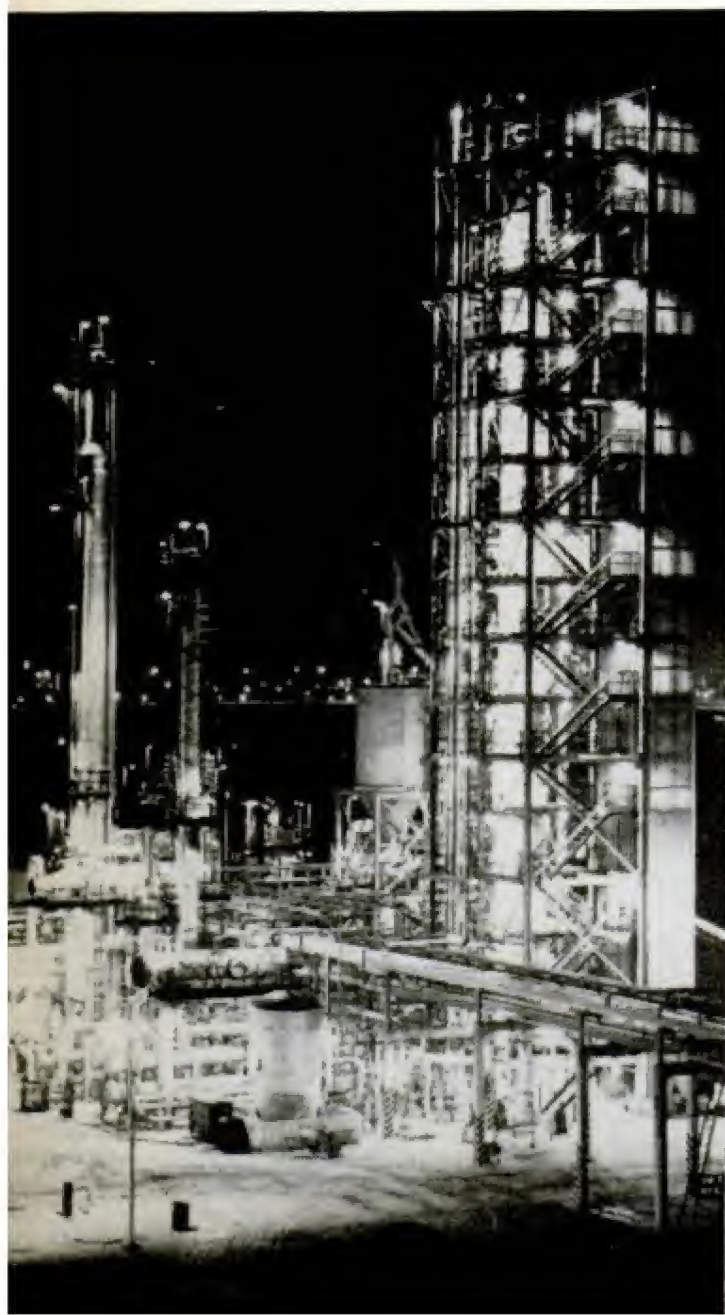
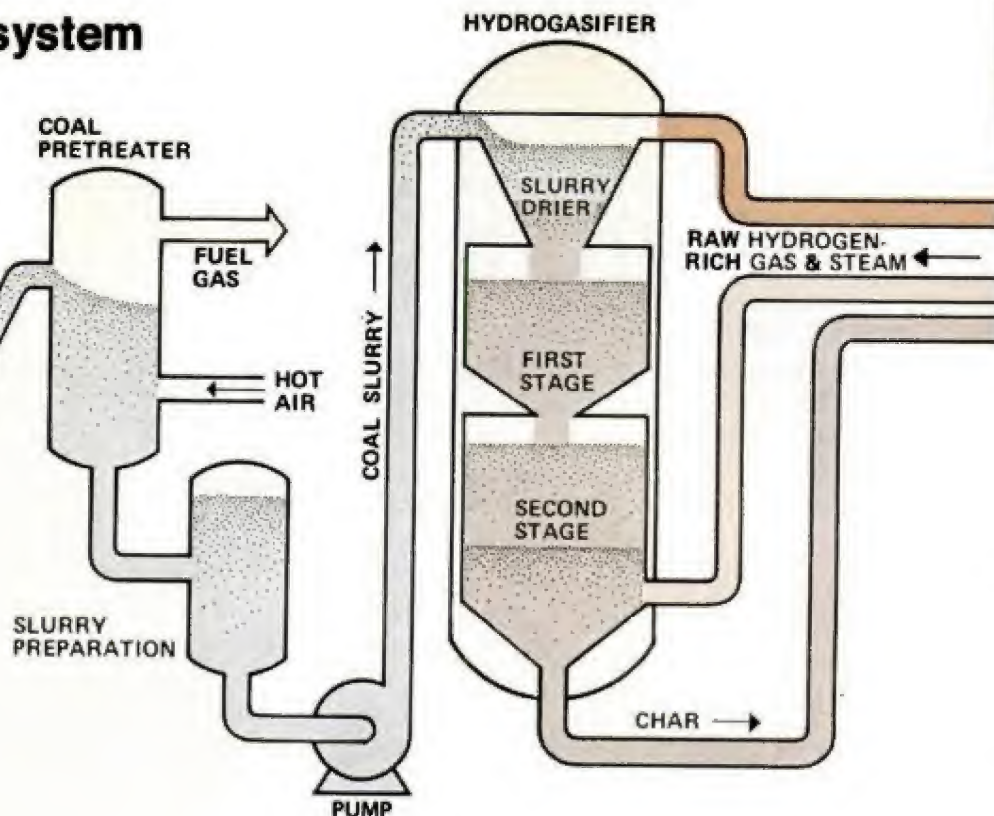
## ENERGY USE IN THE UNITED STATES





# Coal gasification system

The HyGas process takes a coal-oil slurry and its resultant gases through a complex series of steps. The original heat source is electricity. Many of the later steps refine the final products—a char with appreciable heating values retained and a gas said to be of pipeline quality.



the petrochemical industry and the fuel for trucks and aircraft.

"The critical position coal holds in this nation's energy future cannot be over-emphasized, for . . . it is also the energy source upon which we will lean most heavily to effect the difficult transition from where we are today to the ultimate nuclear energy economy."

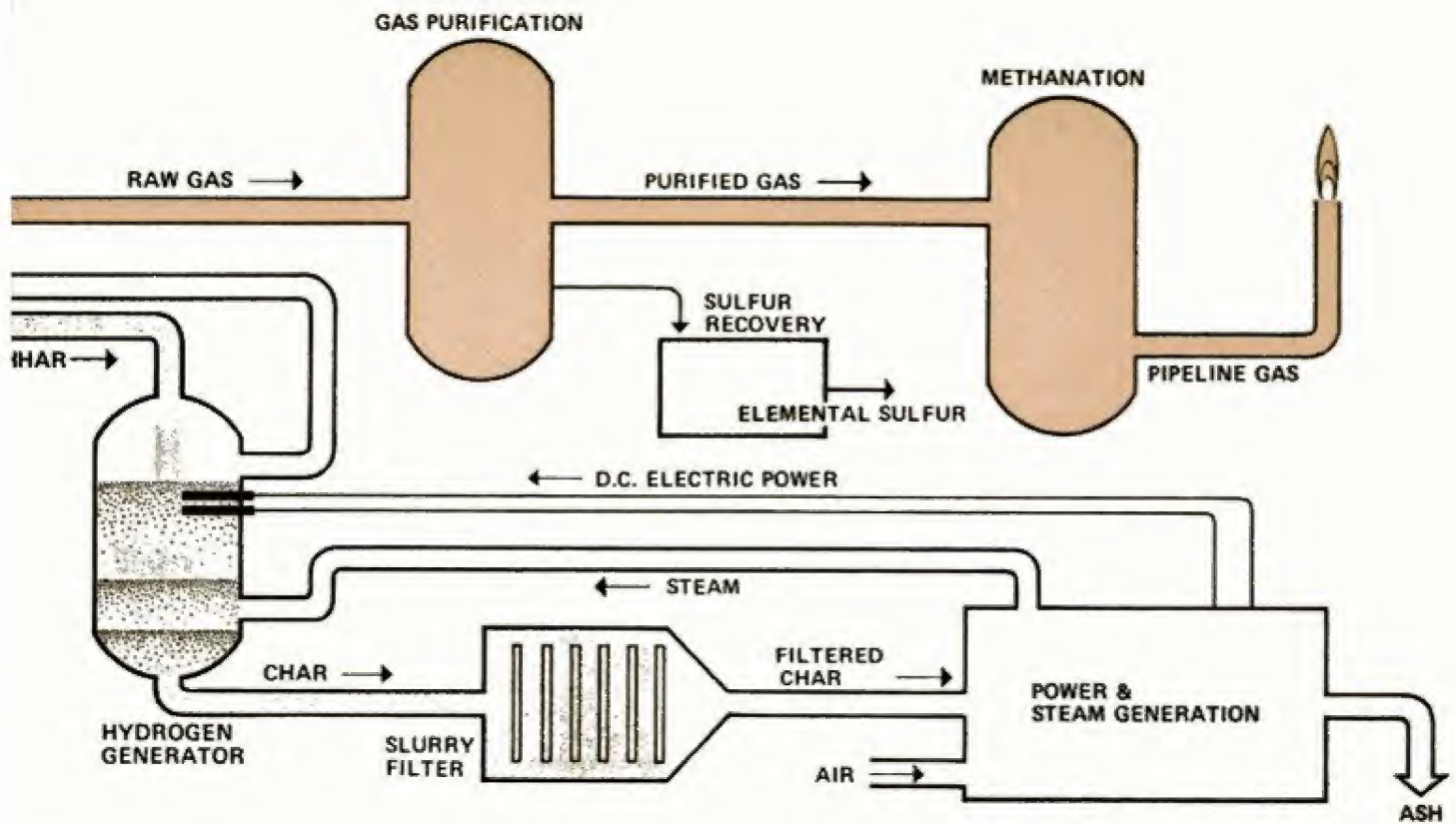
Secretary of the Interior Rogers C.B. Morton observes: "Coal is clearly our greatest asset in the intermediate term. Over 90 percent of America's fossil fuels is coal, compared to about only 4 percent oil and 3 percent natural gas.

"Using much of that coal, however, especially low sulfur coal in the Great Plains states, will mean more strip mining. But with mined land reclamation and new technologies like coal gasification, there is no reason why coal can't be environmentally more acceptable. I personally expect to see several of the new coal technologies under investigation today in the commercial market place by 1980." (More of Secretary Morton's views on the current energy situation appear on page 97.)

The United States has more coal deposits than any other country. Some 3 trillion tons lie buried beneath American soil, two-

**The \$7 million HyGas facility in Chicago is said to be the farthest along of all coal-gasification plants.**





thirds of it said to be recoverable by current methods.

The Office of Coal Research, in cooperation with private power companies and research organizations, is pushing various programs for the development of efficient ways to convert coal into pipeline quality gas, into an industrially useful oil, and into a "cleaner" solid that can be used directly as a fuel. The gas could be piped to factory and the home. Or, like the oil and the solid fuel, it could be used to generate electricity, the form of energy that's vital to a society such as ours. The problem is that electrical generation is very inefficient. Some 60 percent of the energy value of a fossil fuel is lost in the conversion process.

Farthest along of the new coal gasification methods is that used in the HyGas plant in Chicago (the process diagrammed on these pages). The plant is designed to convert 75 tons of coal a day to 1.5-million cu. ft. of high-quality gas.

In this process, coal is mixed with a light oil (a byproduct of the process) and this slurry is heated in a reactor. Chemical reactions and heat exchanges cause the coal to give off most of its gases. Refining removes sulfur in its elemental form—not as a gas but a nonpolluting and valuable solid.

Another pilot plant, in Rapid City, S.D., is designed to test a conversion system called the "Carbon Dioxide Acceptor Pro-

cess." The chemical reaction between a form of lime and carbon dioxide creates the heat needed to achieve coal gasification. The process is designed to convert lignite—a carbonaceous fuel more like peat than coal—into a sulfur-free pipeline gas.

There are experimental systems that convert coal to a high-grade synthetic crude oil. A pilot plant in operation for three years at Princeton, N.J., uses a fluidized-bed system to produce a gas, a solid char and a synthetic crude. Even the char can be used as a boiler fuel.

A fluidized-bed setup is also the basis for a method of burning coal to extract its heat energy directly. Small pieces of coal are mixed with an inert ballast material, which serves to prevent the coal particles from sticking together and forming a slag.

The coal-ballast mix is kept in motion around an array of water-filled pipes by a blast of air from below—that is, particles "float" on a bed of air. Heat from the burning coal particles converts water in the pipes to steam, which, in turn, drives turbogenerators that produce electricity.

Unlike conventional coal-burning powerplants, the fluidized bed can burn any type of coal and yet keep pollutants such as sulfur dioxide down to low levels. A pilot plant at Alexandria, Va., reportedly passed Bureau of Mines pollution tests with ease. Large plants like this could be in operation



as early as 1976, according to the designers of the Alexandria facility.

Though our coal resources could last several hundred years, many experts continue to look toward nuclear energy as the ultimate solution to our problems. They expect to see a big boost in the output of conventional nuclear plants, which today represent but 4 percent of our electrical generating capacity. According to an Atomic Energy Commission projection, this could be raised to 30 percent by 1985.

This would be an intermediate stage. Philip Ross and other experts look to the breeder reactor to carry us far into the 21st century. This type of reactor not only provides power by producing energy in the form of heat, but it also "breeds" new fuel. It converts a nonfissionable form of uranium into plutonium 239, a highly fissionable fuel.

This is of critical importance because conventional reactors, using uranium-235, are even more inefficient than fossil generating plants in providing energy for the production of electricity. They waste such large amounts of fuel (in the form of heat) that in a few decades we might run out of easily mined uranium.

Other energy sources are either limited or far out of reach now. Hydroelectric power can only make a limited contribution. Geothermal energy, obtained by tapping the heat of the Earth itself, is a subject of controversy. There are researchers who say its contribution will always be limited. There is one geothermal plant in operation, The Geysers in California. It

uses natural steam to generate electricity.

Other sources of oil are the very large deposits contained in the mountains of shale found principally in Colorado, Utah and Wyoming. One problem is how to "boil off" the oil in an economical way. Another problem is ecological—what to do with the hills of spent shale.

Though some experts are pessimistic about the possibilities of shale, men like Harry Johnson, deputy oil shale coordinator for the Department of the Interior, are very optimistic. He says: "Most people think commercial oil shale is 10 years away and not competitive. We think it is three years away—and competitive at today's prices."

Solar power is in a similar state of development. Though its potential is great—it's a source of energy that will last as long as the sun—we're only beginning to develop systems to capture its energy on a large scale. (See *Will Solar Farming Solve Our Power Crisis?* page 90, July 1972 PM.)

The ultimate energy, say many scientists, is thermonuclear fusion. Its promise has been evident ever since the first hydrogen bomb was exploded—an uncontrolled fusion reaction. The problem, which some of the best scientific brains are working on, is how to control a fusion reaction.

This energy source is virtually limitless. Fusion uses heavy water, which can be extracted from the sea. Using fusion power, we can then take more energy from the sea in the form of hydrogen. Who knows—maybe 50 years from now Americans will drive cars powered by a nonpolluting "tiger in the tank" called hydrogen. ★★



A pilot plant in Princeton, N.J., has been operational since 1970. It uses fluidized beds to produce a gas, a char and a crude oil. The results are called "encouraging."



# New for snowmos

A growing assortment of add-ons and accessories is arriving each year for snow-country speedsters. Rear-view mirrors for handlebars and mittens, roll bars, track cleats and ski keels, plastic snowshoes, emergency flare and survival kits, front wheels for off-season running, speed kits for better performance and canvas cab covers for warmth are among the new extras.

For cold-weather campers who take their machine along, there are travel trailers with rear garage door so the snowmo can stow aboard. The latest gadgets make travel to new trails easier and safer. ★ ★ ★



**Protection of machines** from slush, gravel and theft is claimed for VersaCap (above). \$340 from Lakeland Mfg., Box 223, Manchester, Mich., 48158. Assorted colors are available. Its TrailAir-Foil is a clamshell shield for front of a trailer. Vinyl-covered \$23 chain and lock set (left) is from Master Lock, Milwaukee, Wis.



**Even tie-down straps** now come in matching colors. Six choices in nylon webbing are offered by AGM Cargo-Ties through snowmobile dealers. After adjusting for fit, a KevLok cam lever tensioning fastener secures machine to trailer, is reported unaffected by ice or mud. Two-corner tie-downs are \$7; four-corner, \$10.



**Pickup portage of a snowmobile** becomes easy with a slanted drive ramp from Pepper Engineering, 4093 Carpenter Rd., Ypsilanti, Mich. 48197. Their portable aluminum two-section Porta-Ramp, 3x9 feet and \$65 f.o.b., weighs 35 pounds and assembles in a minute. Other widths for lawnmowers, garden tractors, ATVs.

**Emergency snowmobile tow strap** is recommended accessory. Eight-foot, 2500-lb.-capacity nylon webbing strap (below) has noncorrosive hooks, comes in seven colors from AGM Cargo-Ties, Tucson, Ariz. Useful for pulling disabled vehicle with driver. Tow sled with passengers, cargo should use bar to prevent overrunning.







## Don't let winter stop your four-wheel-driving fun!

You'll have roads and back country to yourself: no crowds, noise or insects. The scenery is even more spectacular under a snow blanket!

by Barry Lopez

Photos: Barry Lopez and Donald Johnson

**E**ven a dedicated four-wheeler can't quite follow the snowmobiles and ATVs, but you can go farther than you thought.

Running in the winter requires a little more attention to the operation of your four-wheel drive than in the summer. Number one on a prewinter check is a look at the battery. Even a brand-new battery will deliver only 65 percent of its power at 32° and even less, about 45 percent, at 0°. So keep it charged and keep connections clean.

Ignition components should be given a close going over. Gasoline doesn't vaporize as well in the cold so it requires a hot spark from the coil to ignite the fuel mixture.

The next item on your prewinter checklist should be fluids. A 1:1 mixture of permanent-type antifreeze in the radiator will protect you to about 30 below. A can of "dry gas" (an alcohol or acetone anticondensation mixture) to every three or four tankfuls of gas will sop up moisture in fuel lines and prevent icing there and in the carburetor. Keeping a full gas tank also reduces the moisture level. A final note on fluids: Don't forget to mix antifreeze 3:2 in your windshield washer bottle.

After your battery, tires are the next important consideration. You might get a set of full-fledged snow tires with an open-lug design. They'll not pack up with snow as easily as your modified snow tires and tend to be self-cleaning. They are usually noisy, don't wear well and are not safe at very high speeds, but the presumption is you'll be using them only during the winter.

Studs are terrific on ice and packed snow, but do tear up roads and are illegal in various states. If you opt for studs, check local ordinances and get them on all four tires for safety and to "balance" your vehicle's handling characteristics.

Before you hit the back roads, check some extra equipment. Your winter driving kit should include snow chains and chain tighteners with a box of extra links, heavy-duty jumper cables, flat-necked shovel, ax, high-lift jack with a ¾-inch-thick, 2-foot-square plywood platform, and survival kit—space blanket, food, firestarter, and so on. This assumes you have a toolbox, electric tape, spare parts, flares, flashlight, tow chain, can of gas, first-aid kit and other four-wheeling necessities.

The chains and jumper cables explain themselves. The flat-necked shovel is to get between your vehicle and a low spot. It and a high-lift jack will get you out of a ditch



if you slip off an icy road crown. The ax is a major survival tool. You can cut logs to skid your vehicle over bad spots (mud, for example, which is worse than snow to drive in because you can't get a bite or even track straight). You can cut poles to serve as levers when you're stuck, to break through frozen earth to set a "deadman" for your winch, to construct an emergency shelter, and to attend to normal tasks like cutting firewood.

One extra piece of equipment especially helpful in the winter months is a set of driving lamps, one wide-beam and one narrow-beam. Their extra reach and brightness helps when braking distances become longer and poor visibility—snow, freezing rain, fog—occurs.

You should consider carrying various spray-on window de-icers, windshield defoggers, scrapers and other gadgets. I'm happy with an ice scraper and my standard defroster. I do keep a window cracked even in the coldest weather to lower the humidity (your rig's airconditioner will do the same thing; see the instruction manual). I also install a frost shield, an oblong of plastic

**At a backwoods crossroad in Oregon's Cascades (top right) the author checks a detailed U.S. Forest Service map. Note his sunglasses. Don't forget them: In bright sun on a snowy day you would be quickly fatigued without them. If you have only one set of chains (right) put them on front where there's more weight. When going gets rough (below) stop and plan your next moves.**







1



2



3



4

1. **One wheel spins** while other gets no power with conventional front axle. Use chains, rock or back up and take another run at it.

2. **With determination**, a four-wheel drive will buck through snow this deep. Check often to clear snow packed up under hood.

3. **Use vehicle-mounted winch** for drifts. With 150-foot cable you can usually find a tree, or use log buried in snow as "deadman."

4. **The problem of winching** the vehicle down the road in a straight line is solved by letting one end of tow chain center winch cable.

5. **Jack can lift you** out of ditches, over obstructions. Tip jack toward road and alternately "throw" front and rear back onto road.



5

with a rubber rim just smaller than the window glass on my rear window because I have no rear window defogger. The air trapped between the plastic and glass prevents frost and fog buildup.

Two winter-type gadget sprays I do keep around are a can of ether-base starting fluid to hit the carburetor on a cold morning and a can of Dow's Liquid Tire Chain.

Extreme cold takes the flex out of tires, stiffens grease in wheel bearings and slows down oils, so for the first half mile or so take it easy.

Once you're off the highway, check under your vehicle for ice buildup which will damage wiring and block steering. Lock up your front hubs if you have them and consider putting on your chains before you get into hub-level snow so you'll have room to work. Chains on the front are fine because that's where the weight is, but if you're out on the highway put the chains on the rear.

A limited-slip differential which delivers power to the wheel with the best traction is, of course, better than the slip differential which feeds power to the slipping wheel for winter driving. You may, if you spend a lot of time with your rig in bad traction



## Go when that fresh snow is packed in the mountains!

situations, want to get a limited-slip axle in the rear. They are not recommended for the front because they make steering very difficult. A manual transmission is also easier to get along with in the snow than the automatic which encourages wheel spin.

Once you take off over snow-covered roads, momentum is the key to your forward progress. How to get and keep that momentum is a much-debated topic. Some four-wheelers swear by the high-speed creep—low range and second gear. Others say the best is second gear in high range. There is no best. It depends on weight of vehicle, depth and type of snow, width and condition of tires, to note just a few things. You want to keep moving *steadily*, not as fast as you can, and don't want your tires to break away from the snow. Once you lose traction you lose both momentum and control of the vehicle.

Once you're rolling, here are things to remember about winter-driving back roads. First and foremost, stay on them: Offroad driving in winter is an invitation to fallen-through-the-creek disasters. Drive the crown of the road to keep from sliding into roadside ditches. When you come to a turn take it as high as you can and always stay on the high side of a banked road. When you see a hill ahead, begin building up steam immediately. Like a long-distance runner, you never want to break stride. If you stop, stop where you can get going again: at the crest of a hill, at a bare spot in the road.

One thing that makes snow-driving easy is that your vehicle will make its own tracks, so it's usually easy to back up if you get in trouble—unless you're headed downhill. Beware of a downhill run over fresh snow.

If you're bucking deep drifts, check under the hood for snow buildup that can choke your engine. When snow gets wet, however, it can be very rough to buck through. Wind-crusting snow presents more of a problem: Your wheels will break through but your frame may not and this will leave you high-centered. Solution? Have a buddy walk out in front breaking trail—always an excellent idea when you are on a road and in a terrain you are unfamiliar with.

If you get stuck, get out and take a good look at the situation. Are you high-centered? Spinning? Which wheel? Where are your wheels pointing? Which direction do you want to go when you get out? Your answers will tell you in part what to do. This may be the time to put on the chains. Foot your high-lift jack on a suitable platform, jack it up and slap on the chains. If you're high-centered, go to work under the vehicle with your shovel and/or cut poles. If you've slid off into a ditch, your high-lift jack, tow chain and various lengths of tree poles will lever, push, lift, slide, pull and shove you out. The situation will determine the combination.

If it's only a spinning wheel and you have no chains, you should be carrying sand to throw down (rock salt for ice), a gunny sack to stuff with snow and wedge under the wheel, or strips of carpet or metal lath. Or, again, take that ax and cut some heavy brush to wedge under the wheel.

An obvious aid for back-road winter travel is a vehicle-mounted winch. Set up properly, it will pull you out of awful situations. Snow, especially if wet, can create terrific resistance, as can your vehicle if you're pulling it sideways. For these reasons it's a good idea to purchase and use a snatch block—a pulley mounted in a steel housing. You anchor it at the base of a tree, say, run your winch line through it and dead-end your winch line back on your vehicle. This doubles your mechanical advantage. Before you winch out, clear a path for your wheels and vehicle so they don't snowplow.

Other things to keep in mind in the snowy woods: never set a parking brake in freezing weather; *drive* down hills, don't coast or slide; always make slow, clean, deliberate moves on ice; if you're headed uphill and start to lose traction, turn the steering wheel from side to side to help you "walk" up—each turn of the wheels will give your tires a new bite up front.

If you're driving a road that hugs the side of a hill, especially on a southward facing slope, you run a danger of the road giving way; melting and refreezing may have opened cracks. Creeks may lie hidden at the bottom of a hill or at the head of a draw under a thin layer of ice and snow in

*(Please turn to page 182)*



# Firemen with fins

by S. M. St. Germain

**Fog nozzles** spew plumes of spray as firefighting frogmen at right swim in under an otherwise inaccessible pier.



**Relaxing after a tough siege**, an underwater fireman doffs his gear and prepares to stow it aboard a specially equipped tender filled with diving apparatus.

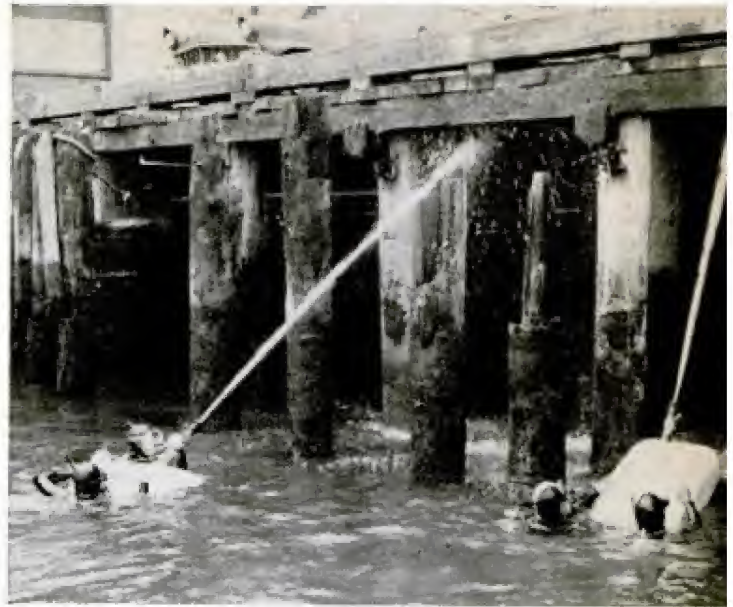
**Y**ou expect firemen to know all about working with water, but not to have to swim in it. Yet that's exactly what many firemen are now doing in such harbor cities as Los Angeles and San Francisco. Water-front pier fires have long been considered among the most treacherous because most of the burning occurs underneath, inaccessible to land-based crews on top. The highly flammable creosoted timbers create a raging inferno that spreads quickly with blistering heat and thick, black, poisonous smoke, making the fire difficult to approach. Not even fireboats with their turret-mounted deck nozzles can reach in under such blazing structures to get at the flames.

But scuba divers, trailing hoses in the water, can swim in under a burning pier and



**Heavy hose lines** are supported on foam-filled fiberglass floats with molded-in handles that permit fire divers to "steer" the water stream in any direction.





Directing streams upward from underneath, firemen in water can get at burning dock timbers that can't be reached by fireboats or conventional land equipment.

attack the fire from below, right at its heart. It all started when a few Los Angeles firemen, skilled in scuba diving as a hobby, volunteered to try the technique. With some reluctance, they received permission. When their efforts paid off in helping to stop a particularly stubborn multimillion-dollar dock fire a few months later, the fire-diver program was officially born.

At first, the heavy, water-filled hoses tended to sink, so plastic floats were designed to support them. The divers work in teams of two to a float, one on each side to guide it. Each fireboat can supply up to five float-mounted hose lines at a time. The nozzles swivel for shooting straight upward and can be adjusted to give either a solid stream or fine-mist spray. Fog sprays are frequently used because they blanket a large area, cool down the intense heat and help to shield divers from falling embers.

The men wear full scuba gear—wet suit, swim fins, helmet, face mask, snorkel and backpack air tank. They breath through the snorkels when surface air permits, then switch over to their air tanks if the smoke becomes too dense. This enables them to remain almost completely submerged for protection against heat and flames. The technique has proved so successful that Los Angeles already has more than 100 specially trained firefighting frogmen, and San Francisco has about 35—ample proof that fighting fire *underwater* can be as effective as fighting it with water. ★★



In a practice session, fire divers demonstrate long reach of their waterborne jet streams. Nozzles can be swiveled to point straight up as well as forward.



# IT'S NEW NOW



## Tough new buggies for land or snow

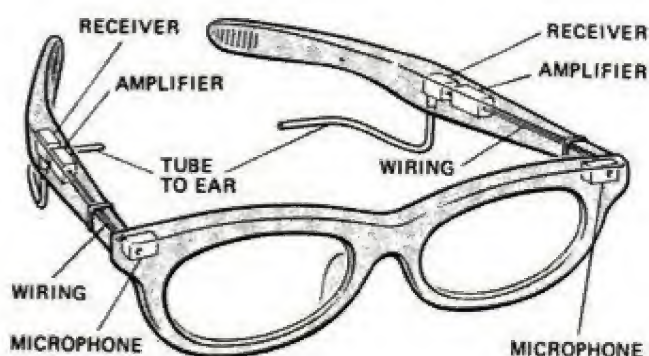
Two new tri-wheelers have joined the growing fleet of rugged, go-anywhere ATVs. One at upper left, BMB's Dragst'r, is actually a five-wheeler, having four-wheel rear drive for added traction. It's powered by an 8-hp engine, can hit up to 40 mph. Below, BGW's Tri-Rod comes with a choice of 5, 8 or 16-hp mills. Both can be fitted with front-wheel skis for use in snow. Further information on specs and prices can be obtained from BMB Co., Holton, Kans. 66436 and BGW Ind., Box 1683, Mansfield, Ohio 44907.



## Invisible hearing aid hides in glasses



You can't tell the man at left is wearing a hearing aid because the microphones and electronic circuitry are embedded in his eyeglass frames. Besides being inconspicuous, system is said to provide improved binaural hearing with a mike for each ear (diagram below) and better directional sound pickup because mikes face forward. Made in men's and women's styles by Dunshaw, Inc., 130 West 42nd St., New York, N.Y.







**Lighted Christmas tree**

Instant holiday decoration for window, wall or doorway, GE's Merry Midget Lighted Tree comes ready to plug in. The green tinsel tree is 18 inches tall with 9 red and 11 green bulbs and a red brick-patterned base. Covered back conceals wiring. Price is about \$6.



**Self-contained smoke alarm gives early warning of fire in the home**

Pyro-Guardion, compact and designed for surface mounting, has ionization detector that responds to combustion products, sounding a high-pitched alarm. UL-listed unit is available in two versions, for new construction and for existing buildings. Each is \$79.95. Pyrotronics Div., Baker Industries, 8 Ridgedale Ave., Cedar Knolls, N.J. 07927.



**High-style night light**

Colonial Night Light gives Early American touch to any room or hallway. Light has switch, 3000-hour, 7-watt bulb and virtually unbreakable polypropylene lamp-post shade, according to manufacturer. UL-listed light, made by General Electric, sells for \$1.29.



**Table saw's features include low price**

New 9-inch table saw has 1½-hp motor with thermal overload protector, ball-bearing construction, self-aligning rip fence, see-through blade guard with splitter and antikick-back attachments. At \$129.99, maker says it's the lowest priced saw of its kind. Power Tool Div., Rockwell International, 400 North Lexington Ave., Pittsburgh, Pa. 15208.





**Cartridge-loading Rollei pops up from pocket size**

Pull the two ends of that compact, featureless box in the lower left photo, and out pop lens and viewfinder of Rollei's new A-26 camera. Pocket-sized, the A-26 takes standard 126 film cartridges. Its CdS light meter gives automatic exposures from 1/30 second at f/3.5 to 1/250 at f/22 and warns of low light levels. Attach the matching C-26 flash, and the aperture is automatically set to match flash output and film speed. Popping the camera closed again protects the lens, meter, finder and soft-touch electronic shutter release.



**Bed of plastic foam stops crash-landing jet—without a scratch**

Kicking up a frothy spray, a British Comet jet simulates a crash landing on a bed of plastic foam designed to keep runaway aircraft from overshooting a runway. The foam strip, developed for emergency use at British airports, stopped the ship in 250 feet without brakes—a fraction of the distance normally required with brakes.



**Pocket 110 camera has built-in electronic flash**

First 110 instant-load pocket camera with 1/1000 second strobe flash built in, Keystone's Pocket Everflash has self-contained lens cover, tripod socket, flash ready-light. Model 120, with f/8 lens, is \$54.95; electric-eye, \$69.95. Model 130 has f/5.6 lens; \$89.95. Model 140 is similar, with rechargeable batteries.





### Point-anywhere lighting screws into any socket

Light goes where it's needed with fixtures that angle and swivel, screw into any medium-base receptacle. With 5-inch extension, fixture is \$5.50; without, \$3.75. Double, deluxe versions also available. Swivelier Co., Inc., Nanuet, N.Y. 10954.



### Tiny bright bulb for high-intensity lighting

New bulb for use in high-intensity portable lamps, accent and display lighting is brighter, cooler, longer lasting than older 110-v. bulbs, uses only 25 watts. "Little R" from General Electric is \$1.75.



### Would you believe—now they're making warships out of plastic!

They're making everything else out of plastic these days—why not warships? First to try it is this experimental plastic-hulled British mine hunter, the HMS *Wilton*. Besides being easier to fabricate, the molded-fiberglass hull lessens the danger of triggering magnetic mines.



### Booster fans for heating, airconditioning ducts

For rooms that are hard to heat or cool, booster fans may make the difference. Permanently lubricated fan cartridge fits standard 6-inch ducts, is held and insulated by a foam-rubber cuff, can be controlled by thermostat or run continuously. \$14.95 at building supply outlets. Airtrol Corp., 203 West Hawick St., Rockton, Ill. 61072.





## New 'little' Leica has through-the-lens meter

Leitz's latest rangefinder camera is nearly as compact as its tiny prewar models. But it incorporates a through-the-lens light meter like its big brother, the Leica M5, and sells for \$600—about half the M5's price. Lenses bayonet in and out of the CL's "M" mount quickly, and the 90, 50 and 40-mm sizes automatically bring the right finder frame into view as they're mounted. Camera is made by Minolta; lenses by Leitz.



## Highway marker bounces back after impact

Widely used in Europe, Flexopost is an extruded polyethylene highway marker that can bend under repeated high-speed impacts, spring back and stay in service, without damaging vehicles. U.S. distributor is the Rodgers Co., Inc., 29-33 Lodi St., Hackensack, N.J. 07602.

## Cordless drill has low price tag

For power where there is none, cordless 1/4-inch electric drill from Black & Decker weighs less than 3 1/2 pounds with self-contained power pack, drills at 800 rpm. Charging unit included gives batteries full charge in 16 hours. Drill lists at \$49.99, 33 percent lower than firm's previous cordless drill model.







### **'Apartment-on-wheels' gives husband-wife truckers the comforts of home**

Carl and Sally Shankle, a husband-and-wife team of long-haul truckers for Mayflower, don't have to leave home when they leave home. Many household comforts go along with them in a special "room" behind the cab of their tractor-

trailer. Paneled and carpeted, it contains such luxuries as hot and cold running water, sink, refrigerator, oven, electric heat, hi-fi and color TV. The Shankles, of Battle Creek, Mich., travel 70,000 miles a year in their apartment-on-wheels.



### **World's biggest penguin?**

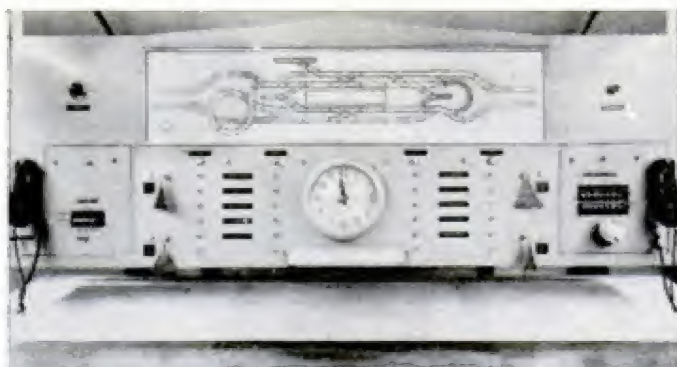
It isn't alive, but it seems to fool its smaller real-life cousin at the Belle Vue Zoo in Manchester, England. The huge 8-foot-tall stuffed penguin was made by a toy company for use in a British movie.



### **Portable/built-in vacuum for RVs**

Compact vacuum with 1-hp motor runs on 110-volt a.c. or d.c., holds 3½ gallons dry measure, is designed for use as a built-in unit in RV or boat, yet remains usable as a portable vacuum. Tools and accessories include a shag-rug head, hoses up to 14 feet long. Prices start at \$29.95. At RV suppliers or from M-V Industries, Box 482, Palatine, Ill. 60067.





## Letters ride faster than people do in London's rapid-postal system

When they say "fast mail" in London, they really mean it. To avoid delays caused by traffic congestion and ever-present fogs that slow surface travel, the British postal system has its own underground railway—the only one of its kind in existence—to speed mail throughout the city. Electric-powered cars like the one at lower left above whisk mail sacks through subway-like tunnels (upper left), shuttling back and forth between central London and six suburban sorting stations

in outlying areas. The tracks run 70 feet below street level and handle an average of 40 trains an hour carrying 40,000 bags of mail. The bags are packed into hoppers (lower right), which then ride conveyors for automatic loading onto the rail cars. The cars are unmanned and operated entirely by remote control from electronic consoles like the one at upper right. Result: London can sort, process and deliver more mail faster than any other city in the world.



## Puck slides on cushion of air for fast action in home hockey game

Fast-moving, friction-free puck floats on a cushion of air forced through 2000 holes in this playing table's surface, while players try to score and defend by hitting it with their "goalies." Air Hockey operates on 115-volt house current, turns into side table or buffet with optional top. Suggested retail price is \$299 at department and sporting-goods stores. Brunswick Div., Brunswick Corp., Skokie, Ill. 60076.





### Forgotten warbirds still fly

Restoring old aircraft is becoming a popular hobby, but British World War II pilot Douglas Bianchi goes a step farther than most. He finds and rebuilds many lesser-known, almost forgotten vintage warbirds no longer thought to be in existence. Some examples, top to bottom above, are early German Fokker E-III, German Storch and Russian YAK-11. Many of Bianchi's restorations have appeared in movies such as the *Blue Max* and *Those Magnificent Men and Their Flying Machines*. His hobby is now a full-time business: Personal Plane Service, Ltd., Wycombe Airpark, Marlow, England.

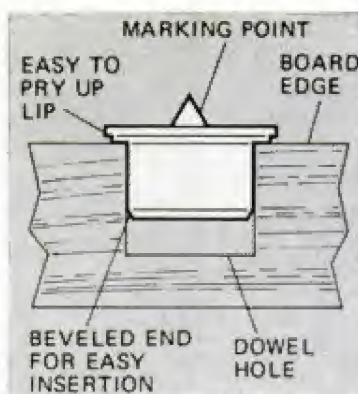


### Personalize your Pentax? Honeywell will do it for you

Telling your Pentax from anybody else's—and making it a lot harder for a thief to sell—is easier now with a new service from Honeywell. For \$10, it will engrave up to 20 characters in black on a chrome Pentax, or in white on a black one; for \$2 additional, it will do this in the color of your choice. Write Honeywell, Box 1010, Littleton, Colo. 80120.

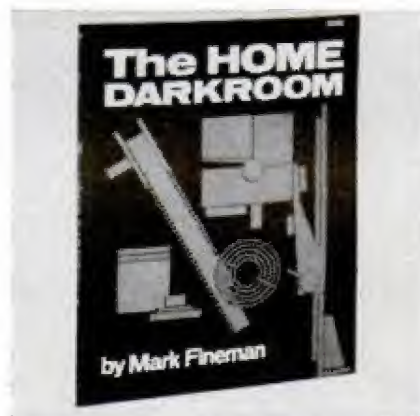
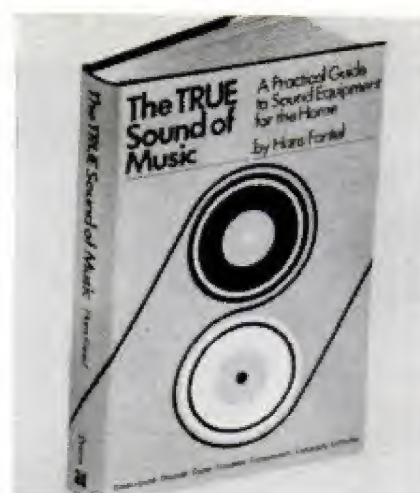


# NOW



## Centers for locating dowel holes

Dowel centers make it easy to transfer dowel-hole locations from one mating part to another accurately. This set has beveled ends that go into holes easily, extra lip for quick removal without gouging wood, includes pairs of centers in five sizes from 1/4-in. to 1/2-in. dia. Plated steel, set is \$1.40 plus shipping from Brookstone Co., Peterborough, N.H. 03458.



## Good books to read or give

*The True Sound of Music*, by PM author Hans Fantel (assisted by PM's Electronics Editor) covers hi-fi and quad sound literately and in depth. From Dutton, \$7.95 at bookstores. *The Home Darkroom* by Mark Fineman (Amphoto) is basic. \$2.95 at photo stores.



## Sparkling bell for seasonal cheer

Merry Midget Lighted Tinsel Bell from General Electric (left) has a dozen gold bulbs on a background of gold noncurl tinsel, a lighted red clapper, green tinsel leaves and a bright red bow. Wiring is concealed by covered back. UL-listed for indoor use, the bell retails for about \$6.



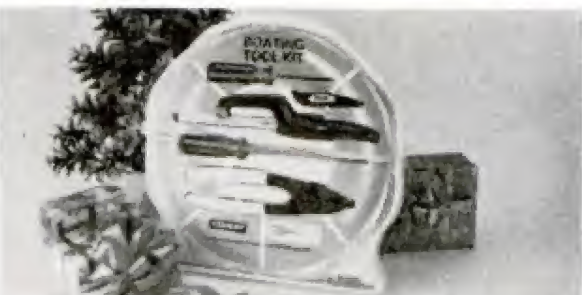
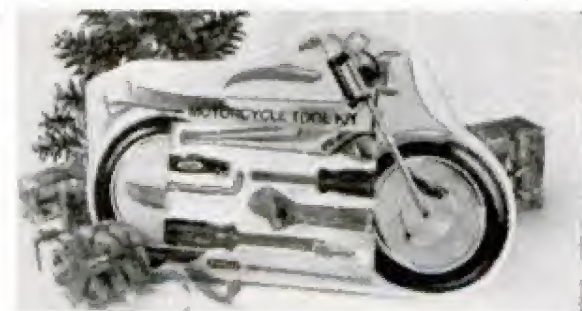


### Wine rack that grows with collection stores bottles the way they should be

Add A Rack cradles bottles in a position that keeps their corks wet—essential for safe wine storage—and protects them from light. The compact rack system (left) can be adapted to space of any shape, expanded in all directions, will hold bottles of all sizes from 6-ounce split to magnum. Available in black, red and yellow, racks can be color-coded to indicate the types of wines they hold. Prices start at \$4.98 for a seven-bottle rack. Add A Rack, Box 30230, Cincinnati, Ohio 45230.

### Toolkits for Christmas have identifying shapes

You won't have any trouble telling what each of these toolkits is for—the shape of the package gives it away. Motorcycle, boat and auto toolkits have suggested retail prices of \$11.97, \$9.97 and \$8.97 respectively. Other outfits in line are a family toolkit, a trailer toolkit and a household screwdriver set. Stanley Tool Div., The Stanley Works, 195 Lake St., New Britain, Conn. 06050.



### 'Double-feature' Super-8 projector shows up to eight film cassettes on free-standing or built-in screen

Furniture-styled so you can leave it out on a shelf between shows, Bell & Howell's new Double Feature movie projector has a TV-like screen of its own built in, but can also project on walls or bigger screens. Loaded with up to eight 50-foot cassettes of 8-mm or Super-8 film, the Double Feature rewinds automatically at each cassette's end, changing to the next cassette when you punch a button. An "Instant Replay" button rewinds rapidly when held, resumes projection when released. Single-speed projector will be \$189.95; Multi-Motion version (with 6 f.p.s. slow motion and 2 f.p.s. stop-motion), \$219.95.









### Handy servo simulator speeds job of adjusting R/C models

New Heathkit servo simulator replaces transmitter and receiver when making fine adjustments on radio-controlled models. Works on all Heath servos and many others, doubles as battery charger. Runs on a.c. or optional battery pack. GD-1053, \$19.95; battery pack, \$9.95. Heath Co., Benton Harbor, Mich. 49022.



### Anticorrosion treatment turns rust into protection

To neutralize rust instead of covering it, Kurust combines chemically with it to form a tough coat that's bonded to the metal surface, keeps water out to prevent formation of new rust. At auto-supply outlets, Kurust is \$2.50 for a 5-ounce can. A. R. Fisher Products, 5-49 48th Ave., Long Island City, N.Y. 11101.



### Saw stores in carrying case

Saw kit from Skil Corp. includes 7¼-inch circular saw with burnout-protected 1¼-hp motor delivering 5700 rpm, safety guard stop and automatic blower to clear sawdust from line of cut. Heavy-duty carrying case stores saw, rip fence, blade wrench, extra blades. Model 574-3 Port-A-Pak is \$34.99.



### Reflection shield saves window shots

Adaptable to most cameras, Flec-Shield blocks reflections when shooting through windows of tour buses, planes, trains, cars or buildings. Made of vinyl-padded aluminum, it slips on and off in seconds, won't interfere with camera settings. It's \$3.95 postpaid from Pantec, 917 Carillo Rd., Santa Barbara, Calif. 93103.



# Atomic pollution: A whopping fish story?

Fears that atomic wastes will kill marine life may prove unfounded, claim British ecologists in this surprising report.

by David Lampe

Photos: Michael Wood



A yearling plaice, healthy and larger than normal for its age, is one of many test fish successfully reared in atomic-effluent waters by British scientists. At left, experimental fish-breeding areas are constantly checked for salinity, temperature, radioactivity and chlorine content. Though abnormally warm and heavily chlorinated, waters were not found to be radioactive.

All over the country, ecologists are screaming about the pollution effects of atomic powerplants being built on our lakes, rivers and coastal shores. It's been assumed that the soup-warm, chlorinated, mineral-dosed water spewing from the massive cooling systems of such generating plants would destroy marine life or at least make fish poisonous with radioactivity. But before these well-meaning dissenters yell too loud, they should know the astonishing results obtained by British marine researchers worried about the same thing.

To sea-bound Britons, good, healthy fish are a vital need, both as a basic food staple in the daily diet and as a major national industry. Thus fishing to the English is as important as corn, wheat and potatoes are to American farmers. In an attempt to increase fish production, British breeding experts recently set up an experimental





fish-farming station at Port Erin on the Isle of Man in the relatively warm, sheltered waters off England's northwestern coast. To their surprise, such succulent species as sole and plaice—ordinarily accustomed to much colder waters—not only thrived there, but grew to maturity in half the usual time, produced greater numbers than expected and were far healthier to boot. Could the warmer-than-normal waters be the answer?

To find out, the researchers set up two more fish-breeding farms, this time deliberately located in inlets heated by the effluence from giant power-generating stations. One was at Ardtoe, the other at Hunterston, both along the southwestern coast of Scotland. Coolants discharged from the huge powerplants kept these inlets as much as 45° F. warmer than water in the open sea nearby. To prevent mussels and other sea organisms from breeding in the power systems' plumbing, all cooling water was heavily chlorinated and treated with minerals. To complicate matters even more, the generator at Hunterston was of the atomic-powered type. Would the 840 gallons it dumped into the inlet every minute of the day and night be radioactive?

But again the same amazing results: Fish grew within less than two years to a size that would customarily take four years. Because of their rapid growth rate, fewer were subjected to diseases and more of the young survived. What's more, not a trace of radioactivity was found in any of them.

While the tests are still continuing, the



**Measuring a turbot** (lower photo above) indicates unusually rapid growth rate in waters warmed by the effluence from powerplant cooling systems—long thought to cause thermal pollution harmful to marine life. At top is one of the dammed-off inlets along the Scottish coast used to test the effects of atomic effluence on fish breeding. The experiments are being conducted by Britain's White Fish Authority, an agency of the government's Ministry of Agriculture and Fisheries.

outlook is extremely encouraging. Scientists theorize that atomic effluence, far from destroying marine life, actually helps to accelerate healthy growth because fish in the unnaturally warm water tend to feed continually throughout the year. In their normal breeding grounds, fish such as sole feed only six months at a time, going into a kind of hibernation during the coldest part of the year. If the British findings hold up, they may lay to rest fears of thermal and radioactive pollution, opening the way at last to uncontested expansion of our much-needed power sources. ★★★



# The diesel: new future for an old engine

Its low emissions and excellent fuel economy make the diesel a promising alternative to the gasoline engine; and now with Peugeot joining Mercedes-Benz in the American market, there's a choice of diesel-powered passenger cars.

by Joseph P. Zmuda

**T**he diesel is the most reliable, long-lasting, economical-to-operate and basically clean engine now, or ever before, built for passenger car use. Many foreign countries have translated the superior economy of the low-pollution diesel into plus factors for themselves and the environment.

Heavy-duty diesel engines are used to economical advantage here in large trucks and buses. But precisely in these applications the idea of clean motive energy is distorted by the image of a dirty, noisy, smoke-belching, foul-smelling engine.

Actually the odor and visible smoke from these large diesel powerplants have obscured the fact that their emissions are less harmful than the more invisible emissions from conventional gasoline internal-combustion engines. Recognition of this fact and diesel economy has led to a re-evaluation of the diesel's role as a powerplant at a time when clean air and conservation of fuel are of prime concern. Consider that: □ Early this year the Environmental Protection Agency (EPA) produced its Request for Proposal No. WA73-R176, *Study of the Problem Areas and Impact of the Diesel as a Light-Duty Powerplant*. When awarded, the study will cover the effects of increased diesel passenger-car applications.

**More people are on the waiting list for a Mercedes-Benz 220D than for any other M-B model. Note: For 1974 the diesel will be the 240D (2.4 liters) and the gasoline model, the 230.**





□ Last February, the prestigious and highly publicized Report by the Committee on Motor Vehicle Emissions of the National Academy of Sciences (contracted by EPA) indicated that the diesel was one of only four types of powerplants to satisfy 1975 model-year emissions requirements. It added that the diesel, unlike the Wankel or conventional internal-combustion engine with their increasingly wasteful fuel consumption, will offer improved fuel economy "competitive with 1970 gasoline engines" and without need for costly smog controls.

□ Peugeot, the biggest manufacturer of passenger diesels, has begun importing its diesel-powered 504 model. Next month this will be available in sedan and station-wagon versions. The 504D is one of six diesel passenger-car models made by Peugeot for sale in Europe.

□ Mercedes-Benz, up until now, has offered the only diesel passenger car available here. Its waiting list is longer than that for any other model in the M-B line.

□ Opel of West Germany, a subsidiary of General Motors, has just begun offering a four-cylinder, four-stroke cycle, diesel-engine option for its two and four-door Rekord and Rekord L sedans. GM obviously feels the diesel has a future, if only in Europe.

□ In the 81 years since Rudolph Diesel patented the first compression-ignition engine that made his name famous, the diesel has won recognition as the only prime mover capable of providing long-lived and reliable service in engines ranging from a few horsepower to more than 40,000 bhp. At the same time it exhibited consistently flat load-efficiency curves, high thermal efficiency and superior fuel economy, even with varying loads and speeds.

Whatever the diesel has going for it, you still might wonder what chance it has of competing with the Wankel, stratified-charge and piston engines. Diesel experts and even the pessimistic-though-honest auto manufacturers make no secret that we have the technology and basic engine types now to produce highly-economical, performance-competitive diesel passenger cars that meet 1976 emissions requirements. Unfortunately, we will not see such cars in general U.S. production for many years. Again, as in the past for small economy cars, we must turn to Europe to meet what is bound to be a growing market for diesel passenger cars.

How about emissions standards beyond

## Driving the 504D Peugeot Diesel



The Peugeot 504 isn't new to American roads but a diesel engine option in four-door-sedan and station-wagon models will be when they go on sale next month.

Driving a diesel can be an adventure—just finding fuel. But then, owners of gasoline-powered automobiles didn't have it too easy either at the time we were looking for fuel for a preproduction 504D that just arrived here from France.

With a diesel, once you've scouted your area for diesel pumps and noted their business hours, there's no inconvenience in keeping the tank topped off. And if you're going to venture far afield, the oil companies publish a nationwide list of diesel dealers. Price per gallon of No. 2 diesel fuel compares to a gallon of regular gasoline these days, but it'll take you two or three times as far as your Gas Gulper V8.

We picked up the four-door 504D in Clifton, N.J., after we had returned a 220D to Mercedes in nearby Montvale. The starting procedure for the Peugeot differs a little from the 220D. In both cars there's an ignition switch, cold-start switch to heat the glow plugs and cutoff control for the fuel-injection pump. In addition to these three controls for starting and stopping the engine, there's an idle-speed adjuster. Peugeot hopes to automate the action of these controls in its production models.

The 504, like its gasoline-powered equivalent, is a very comfortable and well-appointed automobile. It's well built and nicely finished and worth the \$6000 that, in round figures, we guess it will cost in 1974.

The 504D is a bit faster getting up to speed than the 220D (still, both are in the 25 to 30-second range for 0 to 60 mph), but both cars have top speeds in the mid 80s and are at their best in terms of comfort and driving pleasure at turnpike cruising speeds.

Because of the diesel's high compression ratio (22.2:1 for the 504D) and peak rpm that is limited by metering of the fuel, throttle pressure and shift points take some getting used to—otherwise acceleration through the gears will be anything but smooth. What is smooth is getting close to 30 mpg. Even better is the European Peugeot 204 with the 1.3-liter diesel: 40 mpg! But that car isn't "safe" enough for us, says Big Brother. Never mind that it would be one the average man or woman could better afford.—Bill Hartford



1975? Can a diesel really "come clean" for 1976? J.I. Miller, board chairman at Cummins Engine Co., Inc., appearing at EPA light-duty vehicle hearings in May 1971, indicated that the diesel has the potential to meet future light-duty vehicle (LDV) emission standards. Except for excessive nitrogen oxides (NOx) due to high peak temperatures, diesels produced today can meet even the 1976 requirements. But Cummins and other diesel firms are proposing LDV engine design unlike that popular now: a low-compression-ratio, indirect engine that would achieve a high specific output at low-peak cylinder pressures.

N.J.E. Hartwell, ecological engineering manager at Perkins Engines, Inc., believes "the diesel engine—lightweight, high speed, with indirect injection system, possibly lightly turbocharged—can be a very serious contender in the LDV field. It has proven so for taxicab and light van delivery service throughout Europe and the United Kingdom. It has found its place in the Middle East. Israel particularly has found it to be advantageous. In fact, America is the last country to be converted to the cause. We have lightweight diesels running in European cars which meet the U.S. 1975 emission requirements without any alteration from the standard production specification."

The only barrier to the 1976 standards, according to Hartwell, is the 0.4 grams/mile NOx requirement that most authorities consider unreasonable. It is not a scientifically-derived standard, but only a gross percentage (10 percent) of the average levels of uncontrolled 1971 vehicles. In April, EPA indicated this 90 percent reduction "not necessary" and that NOx is

"not the problem" EPA and Congress thought it was.

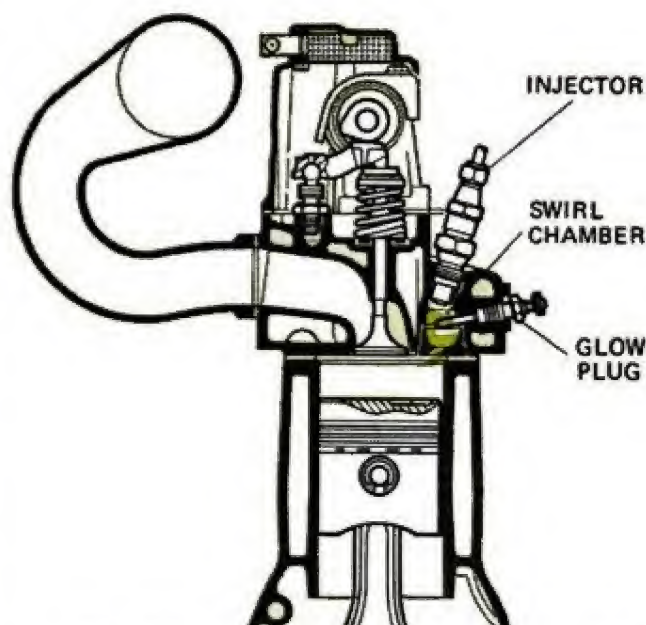
Despite the future certainty of relaxing NOx requirements, Hartwell feels that technology still can get the diesel down to 0.8 grams/mile by combustion system and fuel-injection system redesign alone. There are more decisive changes in the offing.

By resorting to late injection timing, a more constant-pressure cycle-type diagram would be substituted for the typical high-pressure rise (diesel knock) characteristic. Not only would the lower temperatures and pressures bring NOx to below 1976 levels, the engine would be quieter and could be made lighter and, therefore, cheaper.

How much fuel economy can we really expect from future diesels? Hartwell cited a comparison of 1969 taxicabs in which diesel units gave double the hours of operation per gallon of fuel of gasoline units.

"Theoretically, therefore by inference in 1976, the diesel version should be giving at least three times the economy of the gasoline version," he emphasized, "and that's without the additional cost of maintenance of catalysts, afterburners, EGR systems, and so on."

These characteristics of low specific fuel consumption and fewer exhaust emissions are inherent to the diesel cycle. Unlike a



Diesel engines for passenger cars use either a swirl chamber or prechamber above the cylinder. Combustion starts here and spreads down. For cold starts a glow plug heats the chamber.



Diesel engine in the Opel Rekord is, like the M-B and Peugeot powerplants, four cylinders displacing just over two liters. GM does not offer the car for sale in the United States.



gasoline engine that uses an electric spark to ignite the fuel, air in the diesel cylinder is heated by compression so gas temperature alone causes ignition. Instead of using a fixed proportion of fuel and air, diesels run with a precise amount of injected fuel and usually with more air than necessary to support combustion.

Such abundant air assures more complete burning, reducing the production of unburned hydrocarbons (HC) and oxygen-starved carbon monoxide (CO) while at the same time boosting fuel economy. Even the air not used in combustion serves to dilute the exhaust gas, further decreasing the concentration of pollutants.

Besides its strong points, the diesel has its drawbacks: malodorous exhaust, smoking, excessive weight and poor acceleration. But even today's diesels are decidedly improved in those areas.

**Odor:** While the cause of diesel odor is not precisely known, reducing the amount of fuel held in the tip of the injectors was found to work wonders for human sniffers at Detroit Diesel. And engineers at GM found that a simple switch to needle-valve injectors from crown-valve injectors minimized the fuel held below the control valve and reduced odor substantially.

**Smoke:** Black smoke seen when a truck or bus accelerates or climbs a steep grade (lugging down) is actually harmless soot particles produced by increased fuel injection to supply temporary high power at lower air-fuel ratios. By sticking to good engine designs that do not stress overly-high performance, smoking can be avoided during much of the driving mode.

Another smoke-reducing feature involves burning injected fuel in a small precombustion chamber and then discharging the atomized fuel into the main cylinder. Compared to direct injection, burning starts sooner and lasts longer, reducing smoke to below visual level in the lug-down mode.

Smoke reduction means cleaner emissions. For example, Caterpillar Tractor Co. began producing prechamber diesels for various reasons over 40 years ago. Now its latest 1600 series engines meet stringent 1976 standards for CO along with combined HC-NOx standards for 1975.

**Noise:** Noise reduction can be achieved by shielding, powerplant redesign or a combination of both. While total shielding is impossible because of cooling needs, partial shields were introduced with good results

## Driving the 220D Mercedes Diesel



Mercedes-Benz has had a diesel-powered passenger car in the American market for years. I never drove the early 180D, but recently did take out this 1973 220D.

If I wrote about 220D after driving it for an hour, I'd say it couldn't get out of its own way. But after a week I found that even I adjusted to waiting half a minute to get up to 60 mph, changed my driving habits and got a new perspective on the jackrabbit-start syndrome. Reluctantly, after the week, I surrendered the Mercedes, got back in my own car and nearly snapped my neck when I let out the clutch.

Recent experiments with turbocharging passenger-car-size diesels have resulted in impressive acceleration, but such hop-ups will, at least for now, not be done at the factory. So, for between \$7000 and \$8000 you have a choice between the 220D and a faster 220 gasoline (240D and 230 for '74). Fuel economy, simplicity of maintenance and longer engine life dictate the D, not to mention environmental dictates.

Apparently these are the reasons Mercedes has such a waiting list for the diesel and why owners willingly pay a couple hundred more for it. I would seriously consider doing the same.

Advantages of the diesel have seemed more obvious to Europeans, and many Americans have had their first fast, luxurious, diesel-powered ride going to a European airport in a Mercedes taxi.

The 220D is indeed luxurious and, at the same time, a terrific handling car with excellent braking capabilities. Some consider this aspect of its performance a waste—especially when coupled with the diesel's low power output and the fact that the car is so popular among older, retired people. To me the rationale is simple: As aging shaves fractions of a second off your reaction time, the incredible brakes will shave feet off your stopping distance!—Bill Hartford



in the 1950s. Engines now are being re-designed for noise control, and totally new configurations based on low-noise requirements will prevail in the future.

Turbo supercharging, another method of noise reduction, increases the mass of air handled by a given swept volume in the cylinders through the use of compressors driven by exhaust-gas turbines. Combustion noise is reduced along with smoke and gas emissions.

Turbocharging also results in a lower engine speed with a higher specific power and a lower specific weight because smaller cylinder bores—which restrain noise—can be used for a given horsepower. For example, the Perkins six-cylinder diesel normally develops 120 bhp. Turbocharging raises this figure to 155 bhp.

One more diesel high point: McCulloch Corp. is working on a 180-hp, four-cylinder diesel that cuts weight and NOx significantly by reducing internal pressures. Although the project is under tight wraps, automakers are interested in it.

With such present progress and implied future improvement, the only sour note is the unwillingness of the auto industry to launch a time-specific program for diesel LDV development. Industry executives and corporations that work closely with them display evidence of disinterest . . . at least outwardly. Here are some comments:

Morris G. Garter, technical and product information, Ford Motor Co.: "Personally I wouldn't look on the diesel as a replacement for the conventional engine."

J.H. Pitchford, chairman of the directors, Ricardo & Co. Engineers, Ltd., England: "I personally do not see the smaller size of automotive diesel engine, as we know it in Europe today, really replacing the gasoline engine in the ordinary privately owned automobile to any significant extent, but I do see its use in what may be termed the utility class of vehicle."

Sydney L. Terry, vice-president of environmental and safety relations, Chrysler Corp.: "The engineering, development and tooling of several sizes of diesel engines to power all of our cars would take a minimum of five years and would cost in the hundreds of millions of dollars. Since the diesels still can't meet 1976 emission levels and cost substantially more per car than gasoline engines, we do not feel that a massive engineering development program on diesels is justified at this time."

## Results of EPA diesel tests

	EMISSIONS, GRAMS/MILE		
	HC	CO	NOx
1976 NATIONWIDE STANDARDS	0.41	3.4	0.4
1975 NATIONWIDE STANDARDS	1.5	15.0	3.1
1975 CALIFORNIA STANDARDS	0.9	9.0	2.0
MERCEDES 220D	0.34	1.42	1.43
OPEL REKORD 2100D	0.40	1.16	1.34
PEUGEOT 504D	3.11	3.42	1.07

**Low-emissions characteristics** of Mercedes, Peugeot and Opel diesel-powered passenger cars are revealed in tests by the Environmental Protection Agency.

Fred W. Bowditch, director of automotive emission control, General Motors: "I am sorry to be unable to perpetuate an exciting rumor, but I believe you will agree . . . that in their present state of development, diesel passenger-car engines would indeed have difficulty in competing with U.S. gasoline-powered automobiles."

There is an interesting footnote to the official GM stand. One recently-retired, high-echelon GM staff member whose adherence to facts has won out over his commitment to the company line assessed the situation as it concerned the Opel Rekord diesel: "EPA provided me with their figures on its emissions. Although the car is not sold in the U.S.A.—yet—HC and CO are one-third of the 1976 standards! The NOx is high, but no work has been done on NOx and besides, there is no claptrap on the engine."

"What this means is that 'they' can't keep the modified diesel—which we began developing almost 10 years ago—under the rug any longer. GM now has a car on the European market which should embarrass them here in the States."

With today's energy crisis forcing curtailment of fuel consumption, it would be surprising if the Federal government and domestic automakers did not combine efforts to accelerate diesel research and development. Meanwhile, you have a choice between the 220D and 504D. ★★★





# Digital clock kits: fun to build, fun to watch—and oh, yes, they keep time

by Andy Santoni

Photos: Peter Schneider



Six all-electronic clocks you can build from kits, left to right: (back row) Aries, Huni-cutt, ESE Digitime; (front row) Poly-Paks Kronos, Heathkit alarm, MITS. Kits range in cost from \$47 to \$59.95. Time to build them varies from 4 to 10 hours.

Every generation is convinced that the next one will have a softer life. Now they're even making that childhood bugaboo, the "big-hand, little-hand" method of time-telling, obsolete. Digital clocks, displaying the time in large, clear numbers, are beginning to supplant the old, two-handed "analog" models. Already, silent, all-electronic digitals are replacing the not-so-old mechanical drum and flip-chart types. And many of these are now available as kits.

Like run-of-the-mill electrics, the six kits I built and checked used 115-volt, 60-Hz. line current both for power and as a frequency reference to determine the correct time. All featured six-digit, hour-minute-second displays and used seven-segment readouts. But aside

**Time-setting pushbuttons** are unmarked on most clocks, as on Aries (far left). Heath (left) has incomplete markings on bottom setting switches, none for rear-panel alarm shutoff and snooze-delay switches.



from those basic similarities, each took a different design approach.

The simplest, most basic model, was the ESE Digitime ES-112, using incandescent displays and TTL-type, medium-scale integrated circuits instead of the new displays and MOS large-scale integrated circuits used in the other clocks.

Actually, this approach has its advantages: Using medium-scale TTL circuitry, while it increases the number of ICs used, decreases the number of discrete resistors, transistors and such to be wired (the ES-112 was the fastest unit of the group to wire, taking just four hours), and the ready availability of TTL ICs simplifies repair, should that ever be necessary. Price of the ES-112 kit is \$46.95, plus \$12 for the attractive wood case or \$7.50 for the aluminum case (which I haven't seen), plus about \$2 for shipping from ESE, at 506 Main St., El Segundo, Calif. 90245.

The Hunicutt NC-247, another TTL type, uses larger, more legible Sperry gas-discharge displays, and its metal cabinet can be tilted within its wooden end panels for the best viewing angle. The clock takes about eight hours to build and costs \$59.95 plus shipping from Hunicutt Digital Electronic, Box 9793, Fort Worth, Tex. 76107. An \$18/ accessory kit will convert it to a timer.

The more sophisticated approach, using a single, large-scale integrated (LSI) chip containing all the clock circuitry, actually increases the number of parts to assemble. That's because the LSI chips are MOS (metal-oxide semiconductor) circuitry that can't drive the illuminated displays directly. This means you have to mount about 19 extra transistors and several resistors. But the advantages of this approach include smaller power supplies (MOS chips consume much less power than TTL) and the options of wiring for either 50 or 60-Hz. operation and for either conventional 12-hour or military-style 24-hour readout.

With all that extra wiring required, the Aries AR-730K MOS-chip clock took 10 hours to build. It was also the most attractive of the six, though its fluorescent display was the least legible (and the only audible one, ringing faintly as the time changed). It's available for \$47.50 from Aries, Box 808, Peabody, Mass.

The MITS DC-6K, on the other hand, though it shared the Aries's high parts count due to its MOS circuitry, took only



Kits with all clock circuitry on one MOS chip (like Heath, above left) take longer to build than the kits using older TTL chips (like ESE, above right) which require more ICs, but a lot fewer, smaller components.

about six hours to build, thanks to its clearly written manual. I wasn't too happy with this clock's red LED (light-emitting diode) readouts—they're bright, but their segments are distracting rows of dots instead of the continuous bars of the other displays.

The MITS's engineers must have been trained in military electronic design and engineering, judging from their use of very high quality printed circuit boards with plated-through holes and clearly marked component locations, a sturdy aluminum cabinet, and split-ring lockwashers instead of the star-washer types more commonly used in consumer products. The MITS manual was a marvel of clarity, with a delightful component-installation coding system: On each page, components to be installed are clearly designated, while components which have already been installed are blacked in, with outlines showing components to be mounted later. It's one of those simple but effective ideas that always makes you surprised someone hadn't thought of it years ago. The MITS DC 6K is \$58.50 with case, \$49.50 without. If you don't like to see the seconds zipping by, a four-digit (hours and minutes only) version is available for \$10 less. Shipping is \$3 additional. MITS is at 6328 Linn Ave. N.E., Albuquerque, N.M. 87108.

Similar to the MITS is the Kronos MAN-1 from Poly-Paks (Other models are also available). The case is quite attractive, with walnut-finish side and top panels, adding up to a small, neat unit for \$47 plus \$1.50 postage. Building time was nine



hours. Poly-Paks' ordering address is Box 942, Lynnfield, Mass. 01940.

Then, saving the best for last, there's the Heathkit GC-1005. It has all the best features of the other clocks including big bright Sperry displays and the option of wiring it for either 12 or 24-hour operation. But it also incorporates an alarm and a unique power-off warning.

The alarm works on a 24-hour cycle, so it won't go off in the PM when you want it to go off in the AM, and it has a snooze switch that lets you sneak an extra seven minutes' sleep before the alarm goes off again. But both the snooze switch and the alarm shutoff are identical-looking, identical-feeling switches on the back of the clock, so it's possible to confuse them in your morning fog.

Interrupting the power makes the other clocks display random, and possibly confusing, times when they start up again. The Heath's display shows all eights, instead, as a warning. But I would have liked to have the alarm sound, too: then, if power failed during the night, I'd wake up to reset the clock. Still, at \$54.95 and 10 hours' building time, I liked it best.

Setting a digital clock takes three buttons. On all but the Hunicutt and Heath, one button moved the time ahead quickly for hour setting, one moved it ahead slowly to set minutes, and a "hold" froze the time on the clock; you just set the clock a few minutes fast, then hold it till time catches

up with you. The Hunicutt had a variation; its hold button also set the seconds to "00," which I found less convenient. Having to start at 00 seconds every time meant that if I was a bit slow or fast in releasing the hold button, I'd have to wait a full minute to reset the clock accurately. Heath uses still another variation: Instead of a hold button like the Hunicutt's, it has a switch that holds until you click it off again. Also, the Heath's "minute" switch sets only the individual-minute column; to set the tens-of-minutes column, you have to hold both the minutes and hours switches.

These procedures take a bit of getting used to; but of the clocks tested, only the Poly-Paks Kronos and the MITS had clearly marked time-set controls. Heath marked all but the alarm on-off and snooze switches, but had no indication that two switches had to be coordinated to set the minutes. And though the Hunicutt instruction book mentioned a designation label for the buttons, none was included with my kit.

As to time accuracy, though I worried that power-line surges might throw the clocks off (the inertia of a normal electric clock's motor smooths out these noise spikes), I've had them running in my house for a few months, and they haven't gained or lost enough time to notice, even during brownouts. Most important, they tell me the time clearly, even in the dark. And it's been fun building them and talking about them with my curious friends. ★★



That's not the time—just the way the Heathkit warns that power has been interrupted since you last looked at the clock. Random times that are shown by other clocks after power interruptions might be close enough to the right time to be confusing.





# Pocket Super-8s: Home movie cameras you won't leave home

by Peter and Susan Schneider

Photos: Peter Schneider

**N**ext time you go on a trip and can't find room for a movie camera in your camera bag, try slipping one into your pocket. Now there's a whole new breed of versatile Super-8s small enough to whip out of a pocket when the action breaks.

The advantages are obvious. But what about the limitations? If you can't live without features like 8X or 10X power zoom lenses, in-camera dissolves and so on, you'll just have to lug around a full-sized Super-8 camera. And the pocket models are often a bit harder to hold comfortably and steadily. But that's about it.

All 10 of the cameras we tried took sharp, steady, well-exposed films, indoors and out. However, we had some difficulty focusing them accurately at telephoto settings, because of their clear viewing screens. We'd rather see ground-glass, microprism or rangefinder screens, where the image snaps more positively into focus. Of course, there

is ample depth of field to cover focusing errors at normal and wide-angle zoom settings; but if you plan to do a lot of telephoto shooting, you should try focusing any camera in the store before you buy it.

The same holds true for a camera's general "feel" and the way it fits your hands while you're working the controls. Pistol grips are a big help, though they're literally a snag when it comes to putting the camera in your pocket. Three of the cameras tested had such grips: a removable grip with a built-in trigger for the Argus Cosina, a neatly-folding (but awkwardly-angled) grip on the GAF, and a trigger grip that folded back around the camera (making it a bit long for most pockets) on the Nizo. Accessory grips are also available for the Bolex, Eumig and Bell & Howell.

Cameras whose triggers are just beneath their lenses, like the Eumigs and Bolexes, are especially awkward without a grip—





**Pocket Super-8s include** (A) Bauer Star XL, (B) Bolex 350 Macro Compact, (C) Bolex 233 Compact S, (D) Eumig Mini 3, (E) GAF Compact 400, (F) Bell & Howell 670/XL, (G) Rollei SL 86, (H) Braun Nizo S30 (with handle folded back), (I) Argus Cosina 735 (with detachable trigger grip) and (J) Eumig Mini 5. Not quite hip-pocket size, jacket pockets (opposite page) almost swallow smallest camera, the Bauer Star XL (top), easily accommodate even biggest of the group, the Argus Cosina 735. Good things available in these small packages include power zoom lenses, macro focusing, single-framed animation, manual exposure override, mild slow motion (details in chart, page 132).

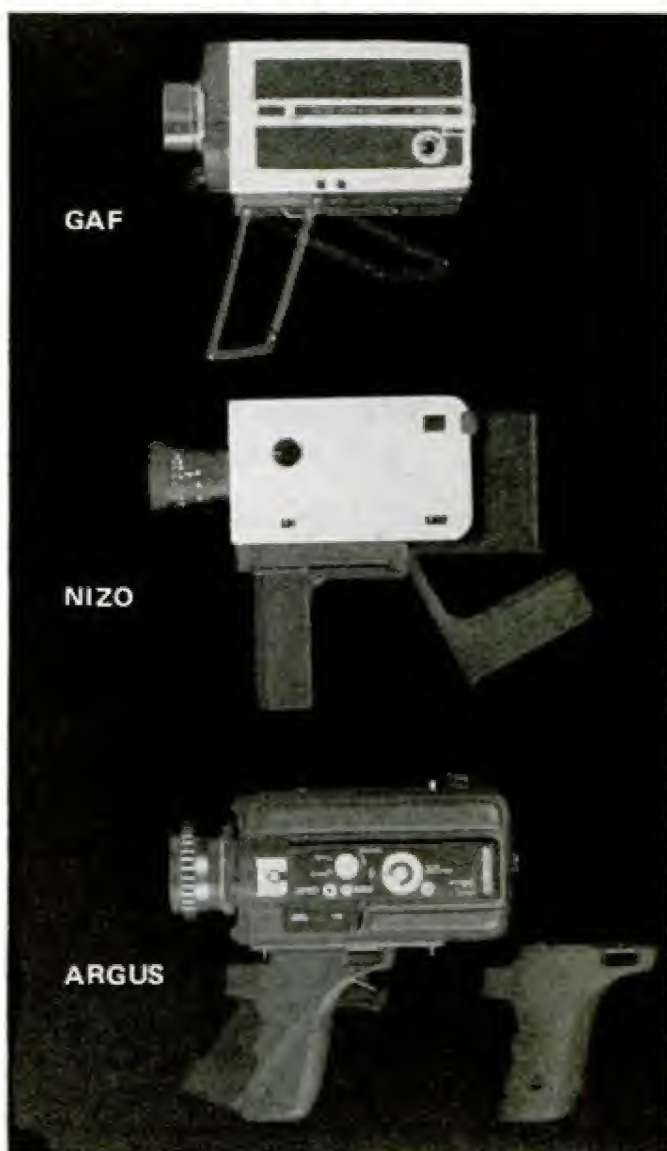
**Handles help you keep a steady grip.** Three cameras came with them (below): GAF's folded flat, Nizo's folded back and Argus Cosina's was removable.

even more so if you want to zoom or focus while shooting (but on the bigger Bolex and Eumig, power zoom helped). The only one I really liked using without a grip was the Rollei, with its trigger on top.

For tripod use, all of the cameras except the Bauer, Bell & Howell and the Rollei had cable releases, and the Argus Cosina and Braun Nizo had electrical remote-control sockets as well.

Optically, the most versatile cameras were the Bolex 350 and the Eumig Mini 5, both of which had 8-40-mm 5X power-zoom f/1.9 lenses that focused to three feet (close enough to fill the screen with a large butterfly, at the 40-mm telephoto setting), plus a macro range that lets you focus to within a few millimeters of the lens. Other power zooms were the Argus Cosina's 8-40-mm f/1.8, the GAF's 4X, 7-28-mm f/1.9, and the Nizo's 3X, 10-30-mm f/1.8.

Manual zooms, which take some practice





## QUICK GUIDE TO POCKET MOVIE CAMERAS

Camera	Price	Weight (with batteries)	Height, Width, Length (plus Lens)	Lens Focal Length, Aperture	Zoom Range, Type	Closest Focusing Distance	Exposure- Meter Type
Argus Cosina 735	\$239.95	2 lb., 2 oz.	3¾ x 2 x 5¼" (+1¾")	8-40 mm, f/1.8	5X, P	4'	TTL
Argus Cosina 755 XL	269.95	2 lb., 2 oz.	3¾ x 2 x 5¼" (+1¾")	9-27 mm, f/1.2	3X, P	4'	TTL
Bauer Star XL	139.95	15 oz.	3¾ x 2 x 5¼" (+¾")	9 mm, f/1.2	None	Fixed	TTL
Bell & Howell 670 XL	119.95	1 lb., 1 oz.	3¾ x 2¾ x 5½" (+¾")	9 mm, f/1.2	None	Fixed	EE
Bolex 233 Compact S	136.00	1 lb.	3 x 1¾ x 5¾" (+1½")	9-30 mm, f/1.9	3.3X, M	4'	EE
Bolex 350 Macro Compact	264.50	1 lb., 10 oz.	3⅞ x 1⅞ x 6" (+1½")	8-40 mm, f/1.9	5X, P	3' and macro	TTL
Braun Nizo S30	225.00	1 lb., 12 oz.	3¾ x 2 x 7¼" (+1¾")	10-30 mm, f/1.8	3X, P	3'	TTL
Eumig Mini 3	119.95	1 lb.	3⅞ x 1⅞ x 5⅞" (+⅞")	9-28 mm, f/1.9	3X, M	"Servo"	EE
Eumig Mini 5	279.95	1 lb., 8 oz.	3¼ x 2 x 6⅝" (+1")	8-40 mm, f/1.9	5X, P	3' and macro	TTL
GAF Compact 400	184.50	1 lb., 9 oz.	3¾ x 2⅞ x 6¼" (+½")	7-28 mm, f/1.9	4X, P	3'	TTL
Rollei SL 86	156.00	1 lb.	3¾ x 2 x 6¼" (+1½")	12-30 mm, f/1.9	2.5X, M	5'	TTL

\*Measured with handle folded

Key to abbreviations: BL, backlight EE, meter with separate window; M, manual zoom;

to use smoothly, were found on the smaller cameras: a 3.3X, 9-30-mm f/1.9 on the Bolex 233; a 2.5X, 12-30-mm f/1.8 on the Rollei; and on the Eumig Mini-3 a 3X, 9-28-mm f/1.9 that's equipped with a unique "Servofocus" system which keeps the lens focused for the maximum depth of field at any focal length.

The Bauer Star XL and the Bell & Howell 670/XL both had fixed-focus, nonzoom lenses with ultrafast f/1.2 maximum apertures for shooting in a dim light. As additional aids to low-light shooting, both of the XL models had nonreflex finders, which don't rob light from the taking lens; for the same reason, the Bell & Howell's meter read through a separate window instead of through the lens.

Actually, all of the cameras could shoot indoor films without movie lights at least some of the time, since all are adapted to the new ASA 160 Ektachrome film, all have reasonably fast lenses, and several have extra-large shutter openings to let in more light. In addition, the Eumig Mini 5 and Bolex 350 can run at 9 frames per second (f.p.s.) to admit twice as much light as they would at the normal 18 f.p.s. rate (and in the process doubling the apparent speed of on-screen action).

About half the cameras also offered one

faster filming speed, for a mild slow-motion effect—more pronounced on the Argus and GAF, with 32 f.p.s. than on the Bolex 350, Eumig Mini 5 and Braun Nizo, with 24. All cameras except the GAF and Bell & Howell also allowed single-frame exposures for animation or time-lapse work, and the Argus even had electronic flash synch (with both hot-shoe and PC-cord connections) for easier single-frame work.

Electric-eye meters in all of these pocket cameras control the exposure automatically, reading through the lens for greater accuracy (and so you can't unwittingly cover the meter with your finger) on all but the Bell & Howell, Bolex 233 and Eumig Mini-3 models.

All of these cameras except the Bauer, Bell & Howell and Rollei also allow some manual exposure control—either a compensator for back-lighted subjects that opens the lens about one stop, a lock that lets you move in close for a meter setting and then hold that setting as you move back, or a full manual override that lets you fade in and out or underexpose for "moonlight" effects in daylight.

Reflex viewfinders that see through the lens were the rule in all but the two XL cameras. All cameras had eyepiece focusing designed to compensate for individual eye-



Meter Override	Battery No., Type	Battery Test	Eyepiece Signals	Cable- Release Socket	Single- Frame Release	Speeds (frames per sec.)	Remarks
L, manual	4 AAA	Yes	f/stop, U	Yes	Yes	18, 32	"Left-eyed" design, flash synch on single frame, remote-control socket, detachable trigger-grip filter switch
L, manual	4 AAA	Yes	f/stop, U	Yes	Yes	9, 18	"XL" version of above (new, not tested by PM)
lone	2 AA	No	f/stop, run	No	Yes	18	Smallest
lone	4 AAA	Yes	Battery, run, U	No	No	18	Filter switch, socket for accessory trigger grip
L	2 AA	No	Run, U, BL	Yes	Yes	18	
L, Lock	2 AA	Yes	Battery, f/stop, U, O, run, end, BL	Yes	Yes	9, 18, 24	Accepts accessory battery chargers for 110-v. a.c. and 12-v. d.c.
lmanual	4 AA	Yes	Battery, f/stop, U, O	Yes	Yes	18, 24	Folding grip, filter switch, remote-control socket
L	2 AA	No	Run, U, BL	No	Yes	18	"Servofocus" keeps lens focused for max. depth of field at all focal lengths
L, Lock	2 AA	Yes	Battery, f/stop, U, O, run, end, BL	Yes	Yes	9, 18, 24	
L	4 AAA	Yes	Film reserve, run, U, O	Yes	No	18, 32	Removable folding handle, retracting lens hood
lone	2 AA	No	f/stop, run	No	Yes	18	Filter switch

l, overexposure indicator; P, power zoom; TTL, through-the-lens meter; U, underexposure indicator

sight variations, and all but the Argus Cosina had eyepieces on their left side, for more convenient right-eye viewing (for left-eyed viewers, the Argus will probably be the first choice).

Additional indicators in the finders (some of them were hard to see) showed, variously, whether the film was running, had stopped or was about to end; whether the film was being over or underexposed or whether the backlight compensator was on and, in some cases, which f-stop was in use. (For details, see the chart above.)

Batteries are penlight size (AA) in some cameras and size AAA in others. They required replacement after about every eight rolls, on the average. The Bolex 350 has a socket for use with an optional recharger and nickel-cadmium batteries. Few of the cameras had removable battery cases, which prevent permanent damage if batteries leak, and we found battery-changing much more difficult on models using the smaller, harder-to-find AAA batteries.

From the smallest camera (the Bauer Star XL), to the biggest (the Argus Cosina and Bolex 350), we found the pocket Super-8s easy to carry with us and hard to leave home. Whether you want to take one home in the first place—and which one you'll want to take—is up to you.

You won't get all the features you'd get from a full-sized camera, but you may get all those that interest you. And a big camera you've left at home might as well have no features at all. ★ ★ ★

**Macrofocusing capability of Eumig Mini 5 (below) and Bolex 350 Macro** allowed close-ups only millimeters from lens. Most minis made respectable nonmacro close-ups at maximum telephoto setting and minimum focus distance; even in normal ranges, Bolex 350 and Eumig 5 were champs, focusing to 3 feet at 40 mm.

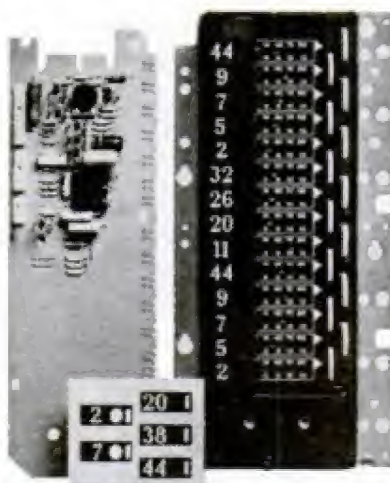
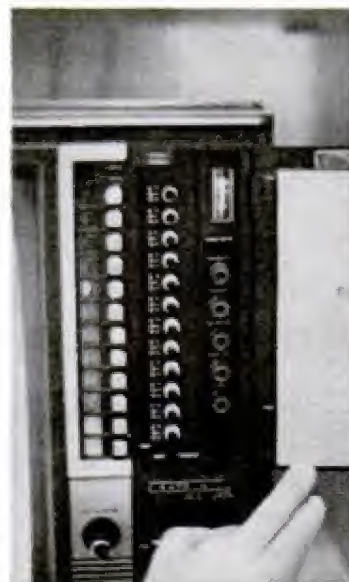




# New in home electronics

There's always something new in home electronics. But this year, though there was a bit less excitement in four-channel products (lots more of them, though), there was a great deal more in other areas than we've been seeing lately. TV innovations included lots of simplified tuning systems (even a prototype that would switch channels for you at preprogrammed times) and more new picture tubes. Car stereo equipment, now tending more and more to in-dash tape/FM/AM combinations, included one such combo that could record cassettes off the air, and a modular component setup (both from Metrosound).

Weather bands showed up on car and portable radios, while Sanyo portable came with an FM wireless microphone, and one Yamaha receiver has a mixing control for wireless mikes. In phonographs, round shapes abounded. Component hi-fi innovations ran mainly to four-channel gear combining *both* matrix and CD-4 discrete disc circuits, more and better cassette decks (including JVC's four-channel one), and more and more self-equalized speakers.



**Easier tuning** is a major feature of forthcoming TV sets. Some Zenith sets have a single control (top, left) that handles the functions of seven knobs. Varactor tuning systems from Sanyo (top right), Zenith (above, left) and others have pushbutton "dials," with one button preset to each station. Sylvania's version makes tuning the only accessible control (above, right); after setting once, all subsidiary controls are swung back in and locked with a key.



**Remote control for any TV**, new Daltone Channel changer slips over tuning knob, lets you change VHF channels and turn set on and off with a wireless hand control provided. No special tools are required. \$39.95. Dalamal, 107 Franklin St., New York, N.Y. 10013.





**Camera for RCA's SelectaVision video tape cartridge system weighs about 2¼ pounds, has a 3-to-1 zoom lens with a through-the-lens finder, and will cost about \$300. RCA also announced 100 prerecorded TV programs. Selectavision will be available "in early 1974."**

**24-channel cable TV capability is built into this new RCA color set, so you don't need to use an unsightly converter and can still change channels with the set's wireless remote control. CableGuard shielded tuning system is found in all-new RCA "XL-100" 21 and 25-inch color sets, which also get off-the-air signals.**



**Superslim 5-inch TV, shown in prototype by Panasonic, uses wide-deflection tube to make a cabinet only 5½ inches deep, 12¾ in. wide, 7¾ in. high.**

**A TV that runs on D-cell flashlight batteries, another Panasonic prototype, runs more than eight hours on nine, readily-available alkaline D batteries, as well as operating from a.c. power or car batteries.**



## Car radios and tape players



Cutting through wind and traffic noises, these new car stereos can bring you clearer sound. Craig's 3139 (above, left) with pushbutton FM-stereo tuner, puts out a hefty 24 watts *continuous* (rms) power; when it does, the Craig badge lights up. The 3139 is \$159.95;

without FM, it's available as the \$99.95 Model 3138. Panasonic's CX-475 (above, right) has a Dynamically Boosted Sound DBS) button to bring volume up to its 12-watt music-power maximum, also boosting those lows and highs easily drowned by noise. \$69.99.



"Now you see it, now thieves don't," should be the motto of Invis-A-Dek. Push an 8-track tape against it, and the controls come into view. Pull out the tape, and it disappears. Car Tapes, Inc., 9180 Kelvin, Chatsworth, Calif. 91311



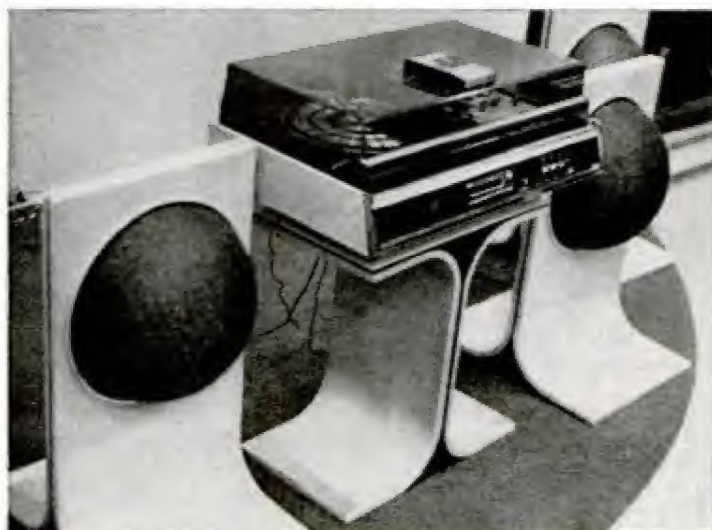
How's the weather up ahead? This Sanyo Weathermatic car radio will tell you. Two buttons can be preset for FM, two for AM, and the fifth button gets you the weather band, for official U.S. government weather reports, 24 hours a day. Model F8572 is \$89.95; stereo Model F8574, \$129.95. Information (on request) from Sanyo Electric, Inc., 1200 West Walnut St., Compton, Calif. 90220



# Phonographs and receivers



**A system of the future from Zenith, the Concept 4X** transmits sound to the rear speakers via infrared light beamed from atop front speakers (left, above), has "touch-plate" controls for radio, tape, volume.



**Novel styling highlights Electroponics "Apollo" compacts**, equipped with curvilinear stands to echo the lines of the omnidirectional speaker spheres.



**Hear TV on the run**, even if you can't watch it, with GE's new P4930 radio. It picks up FM, AM and the audio portions of TV channels 2 through 13. Other features include a.c. and battery operation. \$42.95.



**Panasonic's experimental RF-7000 24-band portable** radio picks up AM, FM and SSB from 160 kHz to 230 mHz., with a motor-driven band selector and a world clock. It runs on battery, car battery or 100-240-v.a.c.



# Turntables, receivers and tape



**New version of the AR turntable, AR-XB** adds cueing lift lever, more low-slung base, to AR's well-known superstable suspension. AR-XB costs \$99.95, Acoustic Research, 10 American Drive, Norwood, Mass. 02062.



**Zero tracking error** isn't yet available at zero price, but Garrard's new Zero 92 model brings it a little closer: just \$169.95, instead of the \$209.95 price of the variable-speed Zero-100-C model.



**Voice-operated tape recorders** tend to chop off the first syllable while they come up to speed. Panasonic's RQ-110S uses a "bucket-brigade" delay to hold the signal back until the tape's moving properly.



**Two heads? No, three:** Second head on TEAC's new 850X (and on cassette decks from Technics and Nakamichi) has separate record and playback gaps, for off-the-tape monitoring, and wider-range response.



**Four-channel receiver** from Onkyo automatically is set to match CD-4, SQ or QS (RM) four-channel records played in any sequence. TS-500 costs \$729.95.



**Dolby noise reduction** is showing up in receivers from Akai (left), Marantz and others, for use in FM listening as well as in tape recording and playback.



**Most powerful four-channel receiver** we've seen yet is this Sylvania RQ3748, delivering 4x50 watts continuous power in quadraphonic mode, 125x2 watts in stereo. Price is \$549.95, less speakers. Features include orientation control to rotate sound field.



# Speakers and headphones



**That end table's a speaker**—Mexico's Romex-Vega three-way system has speakers on adjacent sides for broader dispersion. About \$350. Marketing World, 2280 Grand Ave., Baldwin, N.Y. 11510.



**"Transmission-line" tweeter** on new Infinity Monitor speaker is made under license from Ohm Acoustics, which also makes a full-range version. Signal travels up the cone's steep sides, radiating sideways 360° as it goes. Infinity, 9001 Fullbright, Chatsworth, Calif. 91311. Ohm, 241 Taaffe Pl., Brooklyn, N.Y. 11205.



**Headphones that float atop the head**, instead of hugging the ear, come with new Janszen/Jecklin which has electrostatic speakers, costs \$300. Janszen Electronic Industries, 7516 42nd Ave. North, Minneapolis, Minn. 55427.



**Headphone listening** make you want to close your eyes and lie back on a pillow? Hear-Muffs have pillow built in. Several stereo and four-channel models, from \$30. Hear Muffs, Rogers St., Downers Grove, Ill. 60515.



**Folding headphones**, Koss's new little Travlers snug together for compact storage or traveling. Price is \$29.95, complete with storage/travel pouch. Koss, 4129 North Port Washington, Milwaukee, Wis. 53212.



# Your own business at a price you can afford

by Mort Schultz

**"D**ull, repetitive, seemingly meaningless tasks, offering little challenge or autonomy, are causing discontent among workers at all occupational levels," states a report by the U.S. Department of Health, Education and Welfare. Union and even industry spokesmen voice similar views.

Workers, especially those on assembly lines, complain of boredom on the job. Even increased leisure time doesn't seem to lessen the feeling of drudgery.

"There is very little evidence to suggest that a reduction in working time will increase employee satisfaction while at work," says Sidney McKenna, industrial relations director for the Ford Motor Co.

Of some 50 New Jersey factory workers interviewed by this reporter, 40 expressed dissatisfaction with their work, saying they felt trapped in a dead-end job. Many expressed a yearning to be "my own boss."

If you're dissatisfied with your job and also long to do something worthwhile with your spare time, you might consider starting a part-time business in your home. There are a number of reputable companies that can help you do just that. The "directory"

(see below and next two pages) describes some of them. Incidentally, veterans may be reimbursed for costs under the GI Bill of 1966.

The small business opportunities presented here have been restricted to those which meet the following requirements:

- ☐ A business that can be started in your spare time, so you won't have to give up your full-time job.
- ☐ A business that can be operated from your home, so you won't have to rent space.
- ☐ One that requires little, if any, previous training or education.
- ☐ One that can be started with a relatively small investment, so you won't have to dip into savings.

(Franchise operations are not included because they tend to be full-time ventures from the start and usually require a substantial investment.)

Like others that have started as small, part-time businesses, yours may grow to such an extent that it will require full-time effort. You will then be your own boss; you will have other problems, but boredom won't be one of them.



## CUSTOM CLEANING SERVICE

**Description:** Cleaning tacked-down carpeting or large-size area rugs; cleaning upholstered furniture; cleaning walls and ceilings of homes, offices, and motels, as well as of other commercial and public buildings.

**Business potential:** According to the company that provides cleaning equipment and supplies, it's possible to earn "between \$200 and \$1000 a week."

**Company to contact:** Von Schrader Co., Dept. of Information, 1600 Junction Ave., Racine, Wis. 53403.

**Company provides:** All equipment, supplies, accessories, instructions.

**Your investment:** Carpet cleaning machine, \$750; upholstery cleaning machine, \$578; wall and ceiling cleaning machine, \$350.



## LOCKSMITH

**Description:** Installing and repairing locks, making keys, picking locks, changing combinations, installing alarm systems. Customers are homeowners, auto owners, offices, factories, apartment buildings, hotels, hospitals, other institutions.

**Business potential:** According to the *Locksmith Ledger*, a trade publication, locksmiths earn an average of \$12.50 per hour.

**Companies to contact:** Belsaw Institute, Information Bureau, 315 Westport Rd., Kansas City, Mo. 64111; Locksmithing Institute, Training Information, 1500 Cardinal Dr., Little Falls, N.J. 07424.

**Companies provide:** At-home study course, plus equipment and tools.

**Your investment:** \$275 (Belsaw); \$270 (Locksmithing Institute).



## UPHOLSTERING

**Description:** Custom furniture upholstery for homes and businesses.

**Business potential:** Company claims that you can earn from \$6.50 to \$15.60 per hour.

**Company to contact:** Training Dept., Modern Upholstering Institute, Box 899, Orange, Calif. 92669.

**Company provides:** At-home study course; kit of upholstery tools and supplies.

**Your investment:** \$255 for course, tools and furniture kit.



## TOOL SHARPENING

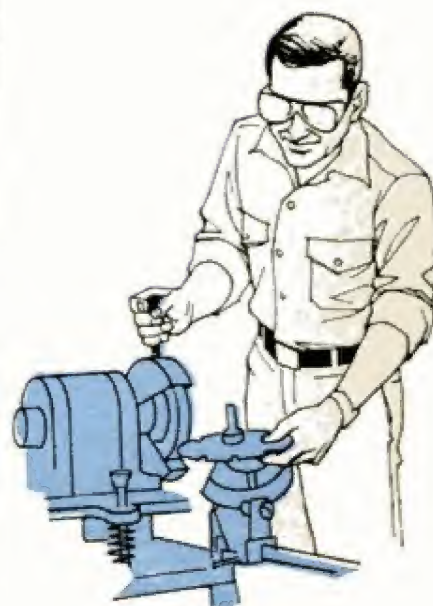
**Description:** Sharpen knives, saws, scissors, shovels, mower blades, ice skates, hedge trimmers and other household, garden and shop implements.

**Business potential:** According to a company supplying equipment and instructions, you can make "\$5 an hour in your spare time."

**Companies to contact:** Belsaw Machinery Co., Information Bureau, 315 Westport Rd., Kansas City, Mo. 64111; Information Dept., Foley Saw and Tool Maintenance School, 3300 Fifth St. N.E., Minneapolis, Minn. 55418.

**Companies provide:** Belsaw Sharp-All machine and operator's manual; Foley offers five-day training program at Minneapolis facility (no training by mail) and wide variety of machines.

**Your investment:** Belsaw machine and manual cost \$279; cost of Foley course (\$195) includes instructional materials, food, lodging and local transportation, but no machines; Foley machines start at \$125 and average about \$500 in price.





## MAKING VINYL REPAIRS



**Description:** Repairing, recoloring and renewing items covered with vinyl—auto interiors and tops, furniture, camping equipment, sporting goods.

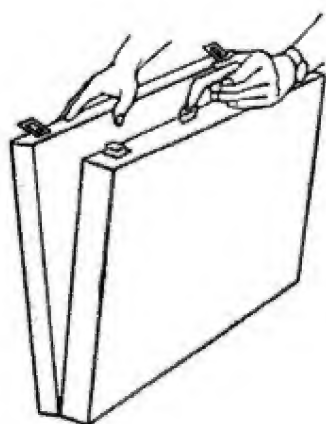
**Business potential:** Company that provides instructions and equipment says earnings of from \$25 to \$35 per hour are possible.

**Company to contact:** Utility Color Labs, Inc., Special Information Bureau, 17301 Edwards Rd., Cerritos, Calif. 90701

**Company provides:** Instructions plus starter kit of tools and equipment.

**Your investment:** \$249 for starter kit comprising both tools and instructions.

## CUSTOM CASEMAKING



**Description:** Making custom cases for individuals whose work requires them to carry samples or equipment. Photographers, salesmen and repairmen are among potential customers.

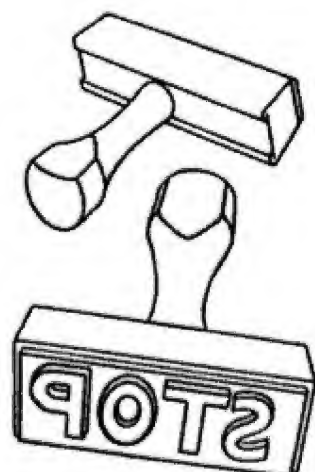
**Business potential:** No figures available. Company that provides instructions states: "Because every job you do is 'special' and different, you can name a top price for your time, your services and your materials."

**Company to contact:** Custom Case Supply Co., Office of Training, 6075 DeSoto Ave., Woodland Hills, Calif. 91364.

**Company provides:** At-home study course. Materials for making cases are sold to you "at discount."

**Your investment:** \$59.95 (for study course only).

## MAKING RUBBER STAMPS



**Description:** Making and selling standard and made-to-order rubber stamps for individuals, firms, hospitals and other organizations.

**Business potential:** According to the company that supplies this equipment and instructions, "your possible profit per hour is \$22.65."

**Company to contact:** Rubber Stamp Div., Warner Electric Co., Inc., Information Center, 1512 Jarvis Ave., Chicago, Ill. 60626.

**Company provides:** Instructional material and Shop B—rubber stamp vulcanizing press, type faces and various other supplies; or instructional material and Shop A—rubber stamp vulcanizing press, greater selection of type faces and more extensive supplies.

**Your investment:** \$499.95 (Shop B); \$745.35 (Shop A). ★ ★ ★





First twin-prop mini copter is this Bensen B-16S powered by two 45-hp Kiekhaefer snowmobile engines. Nose cowl is also from snowmobile.

# New build-your-own copters: More power, looks, convenience

By Sheldon M. Gallager  
and Howard Levy

PHOTOS BY HOWARD LEVY

Those tiny one-man "back-yard helicopters," once considered curiosities in the aviation world, have come a long way since their introduction 20 years ago. Highly refined, sturdily powered and slicked up in appearance, the latest models offer low-cost fun and thrills to countless numbers from those who never dreamed of getting off the ground at all to seasoned pilots who find the mini whirlybirds an exciting change from conventional flying. At a Midwest air show this past summer, a Bensen Gyrocopter put



Fitted with floats, this amphibious autogyro can operate from land or water, was modified from a standard Bensen B-8M single-seater Gyrocopter kit by J. Hasselfeldt of Royal Oak, Mich. Cost, including the engine, fiberglass hull and outboard sponsons, came to \$3200.

on an aerobatic demonstration that left crowds breathless. Another Bensen recently set a world's distance record making a 3400-mile cross-country flight from California to North Carolina. The day of the personal helicopter as a sure, safe, serious form of sport flying has arrived.

The two leaders in the field, Bensen's Gyrocopter and RotorWay's Scorpion, both have innovations for the coming year. Bensen is pioneering a twin-prop version designated the B-16S—the first multiengine



## Twin tails, engines, seats



**Latest addition** to the growing fleet of build-your-own copters is this sleek single-seater Gyro-Falcon autogyro featuring a fully enclosed fiberglass cockpit. The twin-tailed, pusher-prop ship is powered by a 90-hp McCulloch engine, has a rotor diameter of 22 feet. It hits a top speed of 90 mph, climbs 950 feet a minute, can land in 20 feet. Other features include a mechanical spin-up system for the rotor and hydraulic disc brakes. Construction plans are \$35 from Rotor-Hawk Ind., 9007 Henderson Rd., Goodrich, Mich. 48438.

craft of its type. It also features a semi-enclosed cockpit, providing added warmth and security for those who may feel a bit exposed at 3000 feet in Bensen's traditional bare-seat models. RotorWay's newest offering is a two-seater called the Scorpion Too—the first midget copter to carry a pilot and passenger. This has a fully enclosed, smartly styled, cab-type cockpit that gives the ship a sleek appearance as well as all-weather protection. As with their predecessors, both the new Bensen and Scorpion models can be scratch-built from plans or assembled from prefabbed parts available in kit form.

Technically, there's an interesting distinction between the two types of ships. The Bensen is an autogyro with a free-turning, nonpowered rotor for lift and pusher props for forward thrust. The Scorpion is a true helicopter with a powered rotor and no independent propeller. It gets both lift and forward motion from its rotor. To avoid confusion, the two are loosely referred to simply as "rotorcraft" or "rotary wing" craft. Each has its proponents. The Scorpion, with its powered rotor, is capable of vertical takeoffs and landings just like its bigger cousins. The Bensen requires a take-off run of about 500 feet to accelerate the rotor up to lift speed. Once the ship is aloft, however, the rotor autorotates for long



**Beefed up with twin props** and sporting a streamlined cockpit cowling, new Bensen B-16S (top photo above) takes on a slicker, more modern appearance than its traditionally sparse predecessors. The closely spaced side-by-side props (center photo) overlap each other, but are offset just enough to provide safe clearance. Engines are dual 45-hp Kiekhaefer Aeromarine powerplants delivering a total of 90 hp. Like the basic Bensen single-engine B-8M, the B-16S is an autogyro, using a free-turning rotor for lift with prop power for forward thrust. Cruising speed is 75 to 80 mph. Semi-enclosed nose cowling tilts forward (bottom photo) for easy access to cockpit, is actually a snowmobile hood. Landing gear includes steerable nose wheel, can be replaced with floats for water use, skis for snow.





**Two-place version** of RotorWay's Scorpion is new for '74. Like its single-place forerunner, it's a true helicopter with powered main and tail rotors, cyclic pitch and collective controls. Called the Scorpion Too, it has a 140-hp Vulcan V4 engine, cruises at 75 mph, climbs 1000 feet a minute. Rotor diameter is 24 feet; range, 125 miles on standard 10-gallon fuel supply. Payload is 435 pounds—ample for a hefty pilot and passenger. Ship shown here was customized by builder Charles Murphy of Hastings, Mich., to include such extra features as a retractable landing light and elaborate electronic control console (bottom photo above). Basic plans for the Too are \$75 from RotorWay, Inc., 14805 South Interstate 10, Tempe, Ariz. 85281. Partially prefabricated parts are also available in kit form.



He's sitting on his gas tank—in fact, the whole seat is a one-piece molded fiberglass fuel supply designed to save space and weight. One of the newest wrinkles in rotorcraft equipment, the seat tank, developed by Ken Brock, is available as an accessory at rotorcraft dealers. Here, it's been incorporated into a standard Bensen B-8M Gyrocopter built from plans by Russell W. Jansen of Ridott, Ill. The Bensen plans sell for \$35.

glides and safe power-off landings in a small space.

As advantages of the autogyro design, Bensen claims lower cost, less power requirement and easier construction. Since the free-turning rotor exerts no counter torque on the ship, the need for a stabilizing tail rotor is eliminated and controls are simplified. The Scorpion uses a reversible-pitch tail rotor to control yaw, while the Bensen is steered by a conventional rudder. Power is 90 hp for the Bensen, 140 hp for the Scorpion Too, 22.7 feet for the Bensen B-16S.

The reason for going to twin props in the new Bensen B-16S is that the two 45-hp engines, while providing the same total power as the single 90-hp engine normally used, actually produce increased thrust because of their greater combined prop-disc area. The engines are also smaller, easier to maintain and offer backup safety—should one fail, the ship can operate on the other.

Prices for plans have not yet been established for the Bensen B-16S, but are \$75 for the Scorpion Too. Further information on other models and kit prices can be obtained from Bensen Aircraft Corp., Box 2746, Raleigh-Durham Airport, Raleigh, N.C. 27602; RotorWay, Inc., 14805 South Interstate 10, Tempe, Ariz. 85281. ★★★



# How to stop wind noise!

Here are the surefire ways to keep out the wind and the rain.

by Mort Schultz

**Y**ou don't have to endure irritating wind noise while driving. Nor do you have to take a chance of getting wet because of a leak into your car when it's raining. Just use the same techniques that the pros use to find and fix these problems.

There are two kinds of wind noise: that caused by air leaks and that by turbulence.

Air leaks occur when weatherstripping around doors and windows wears out, wasn't installed properly to begin with or doesn't seal for some other reason. Turbulence—the interruption of airflow around the outside of a car—is caused by the shape of the body, or a protruding or loose part.

You can often trace an air leak with the car parked in your driveway. Troubleshooting noise caused by turbulence usually requires on-the-road testing.

## Tracing an air leak

Noise caused by an air leak occurs frequently when air leaks *out of* rather than into a car, because air pressure becomes greater inside the car than outside. This happens when you drive with doors and windows closed, and air vents open, or the heater or airconditioner turned on.

Higher in-the-car air pressure forces the top edges of door glass outward. If glass loses contact with weatherstripping, the air leak that results will produce an annoying noise.

Air leaks that cause noise are normally confined to the upper part of a car to about a foot below the bottom of windows. Leaks lower down cause drafts, and may let dust and water into the car, but they seldom produce noise.

To troubleshoot a noise created by an air leak, proceed as follows:

Examine all weatherstripping for worn-out spots, tears and looseness. Reglue loose weatherstripping, using rubber cement. Worn-out weatherstripping can often be salvaged by inserting some roll-type caulking beneath the worn spot. If weatherstripping is torn or badly damaged, replace it.

Inspect each door for holes in the sheet-metal joints and for rotted-out spots. Remove rust and seal holes with auto-body caulking compound.

The bottom of each door has drain holes that allow water getting inside the door to run out. This prevents rusting.

Door drain holes must *not* be sealed. In fact, you should make sure they are free. Use an awl, icepick or some such tool to clean them out.

Examine door-opening surfaces for solder lumps and other uneven spots that are preventing full contact of weatherstripping with the door frame. Solder lumps should be filed off or cut off with a hammer and metal chisel. Weatherstripping must have an even surface against which to seat firmly if air leaks and the noise they produce are to be prevented.

Since the most minor irregularity may allow air to leak and could escape detection, your inspection to this point may not have produced results. So, roll up all windows and shut fresh air inlets. The inside of the car must be completely closed off.

Start the engine and set heater or air-conditioner controls to admit air into the car. Place the blower at top speed.

Get out of the car. Check that doors and windows are tightly shut, and allow pressure to build up inside several minutes.

Take a length of hose, hold one end to your ear and pass the other end slowly around the edges of doors and glass. Even the hiss of a small air leak will be audible.

The hose method of finding a leak is almost as reliable as modern electronic air-leak detectors used by some auto body and glass shops. The usual electronic detector consists of two components.

One component is a signal generator that



# and water leaks



**Weatherstripping is shimmed** by pulling the seal away from the frame and placing roll-type caulking under it.



**Small construction imperfections** such as solder lumps can be the cause of annoying noise around windows.



**Solder lumps and high spots** can be chipped off with a hammer and chisel. Take care not to nick surfaces.

is placed inside the closed car. The other is a detecting unit held outside the car to pick up the generated tone signal. The signal can't be heard unless it is "leaking" from the car.

If you took your car to a shop that uses an electronic leak detector, the manager might not charge you for finding the leak. However, he would expect to make repairs, and they aren't free. Managers of other shops tell us that they charge up to \$10 for tracing air leaks.

Up to now, we've been dealing with noise made by air from inside of the car leaking out. However, air can leak into the car from the outside as well, creating noise.

To determine if a leak exists because of a bad weather seal around the door, place a strip of paper between the weatherstripping and door frame. Do this around the perimeter of the door, making sure you test every section of weatherstripping.

Pull the paper out. If it comes easily, without resistance, the weatherstripping should be shimmed or replaced. However, if weatherstripping doesn't seem worn or loose, the door may be misaligned and require tightening of hinges, repositioning of the striker or some other adjustment.

Air can also leak into a car from around windows. Close each window tightly and



**Air leaks can be detected** with hose used as stethoscope. Car is closed tight with fan blower running.



# Window molding strips are main cause of turbulence noise



**Check weatherstripping** by closing the doors on strips of wrapping paper to see how snugly they're held.

blow tracing powder or chalk in along the edges. Check for traces of powder or chalk on the inner side of the window. If dust shows up on the inside, the window seal may have to be replaced or the window may have to be readjusted.

## Tracing noise created by turbulence

You won't be able to get rid of all noise made by turbulence. There will always be some because of the design of the car.

A perfectly streamlined car wouldn't create turbulence. But it wouldn't provide much room for comfort either.

So, although some turbulence noise will be heard, you don't have to stand for noise produced by a loose or protruding part. But you have to find it. Here's how:

For your road test, select a route in an open, low-traffic area which will allow you to drive at cruising speed and to pull safely off the road to make adjustments. Equip yourself with a roll of masking tape and strips of automotive caulking. Close all windows and doors tightly. Make sure the blower is off, fresh air vents are closed, and heater and airconditioner controls are off.

Drive at the speed at which the noise annoys you. If the noise seems to be outside the car, it is being caused by turbulence. If the noise sounds to be in the car, you may have an air leak that was unnoticed during the driveway test.

Using masking tape, cover each part of the car's body that may create turbulence and noise. Molding strips are prime candi-



**Window seals can be checked** using a marking chalk that comes in a squeeze-type container (see text).

dates. Cover a small section at a time. When the noise disappears during a particular phase of the road test, it means you have found the offending area.

Quite often, noise created by turbulence occurs when wind whips beneath a strip of molding and rushes through the "hollow." This can be corrected by removing the molding strip, filling the space with automotive caulking and replacing the strip.

Another part creating noise is the weatherstrip around the outside of vent windows, especially at the lower front corner. The weatherstrip here may be distorted and pulled away from the body. Called a pucker, this could have been caused by overtravel of the vent. If weatherstrip is rubber, get rid of distortion by softening it with a heat source, such as a propane torch. When the material becomes pliable, smooth out the pucker and work the weatherstrip into shape as it cools. The distorted spot may need a few heat applications before it is finally smooth.

Another source of turbulence noise is roof railings. These, too, should be taped one small section at a time until the road test demonstrates that the noise disappears, revealing the offending section. If rails are rusted or have pulled away from the body of the car, they should be repaired if noise is to be eliminated.

## Tracing water leaks

There are several spots through which water can leak into a car, but the front and





**Rubber seals** will most often "pucker" in the corners. Remedy is to carefully heat and smooth the rubber.



**Special clip tool** is used to remove windshield molding without cracking glass so caulking can be applied.

rear windshields are always prime candidates. Concentrate on the front one if water has appeared in the front of the car. Test the rear windshield if water has leaked onto the rear deck or into the trunk.

Tape a garden hose, minus a nozzle to the top of the car and place a can in front of the snout. When you turn on the water, see to it that water disperses itself over the entire surface of the windshield.

Keep water flowing for at least 30 minutes; it may take this long for water to show up inside the car. Every several minutes, rock the car from side to side. Water occasionally accumulates in a seam along the windshield and will leak into the car only when the car corners.

Resealing a front or rear windshield is no easy task. You shouldn't apply sealing compound right over molding. It often won't provide an adequate seal, and if the windshield ever does have to be removed, your chances of breaking the glass will be increased.

Molding should come off, but don't use a screwdriver or some other common tool. You could crack the glass. Instead, get a windshield clip tool (it costs about \$2) from a dealer of auto supplies. Slip the tool beneath the molding and slide it along until it touches each molding clip (see photo above, right). Twist the tool to pop the molding loose from the clips.

Buy new molding clips (same kind as the old clips) from an auto glass dealer and insert them into place along the glass. Now,

apply a liberal bead of windshield sealer around the entire circumference of the windshield. Reattach the molding by pressing it onto clips.

If a water leak up front isn't uncovered by hosing down the front windshield, apply a heavy flow of water from a hose (no nozzle) for several minutes on each spot up front that may be leaking. These include every bolt and seam along the firewall, drip rails, and the A-post (the part of the body on each side of the windshield).

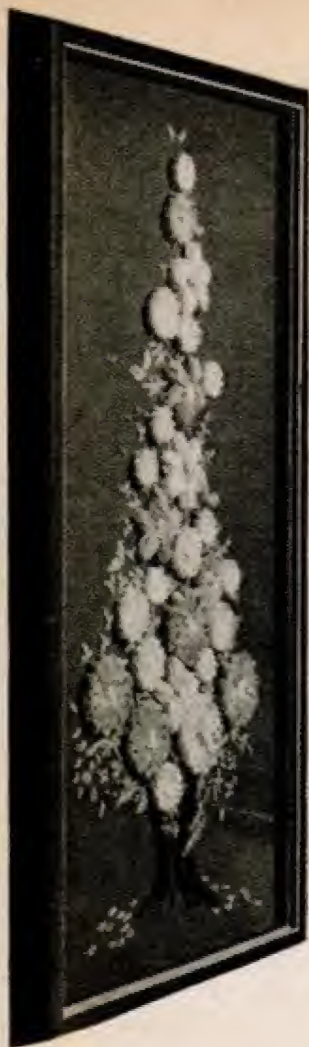
Have someone in the car yell when water begins to leak. When this leak is revealed, seal the weak area with silicone rubber caulk.

If water is leaking into the trunk by some other way than through the rear windshield, the location of the leak can be found by having someone crawl into the compartment with a flashlight. Close the lid and play a heavy stream of water from a hose (no nozzle) along each part through which water can leak—including the trunk-lid seam, stop and backup-light seams, and rear body seams. Be sure to concentrate a heavy flow of water on one section at a time for a long enough period. When your friend in the trunk sees water starting to drip in, he can yell or tap on the lid to tell you to open up.

A leaking trunk lid can often be repaired by prying off the gasket, repositioning it and gluing it back into place. Leaky seams around the lights and body can be sealed with automotive blind side so that patching material won't show.

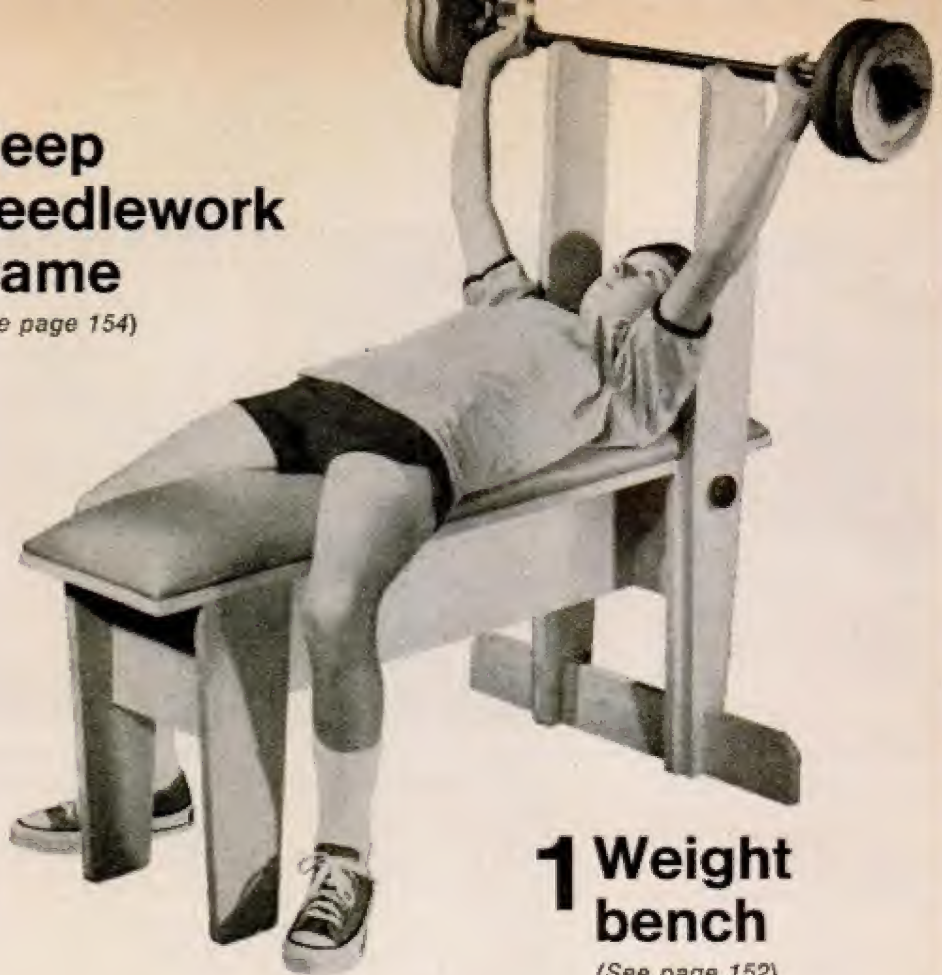
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## 2 Deep needlework frame

(See page 154)



## 1 Weight bench

(See page 152)



## 4 Wall-mounted message center

(See page 156)

## 3 Shuffle-board table

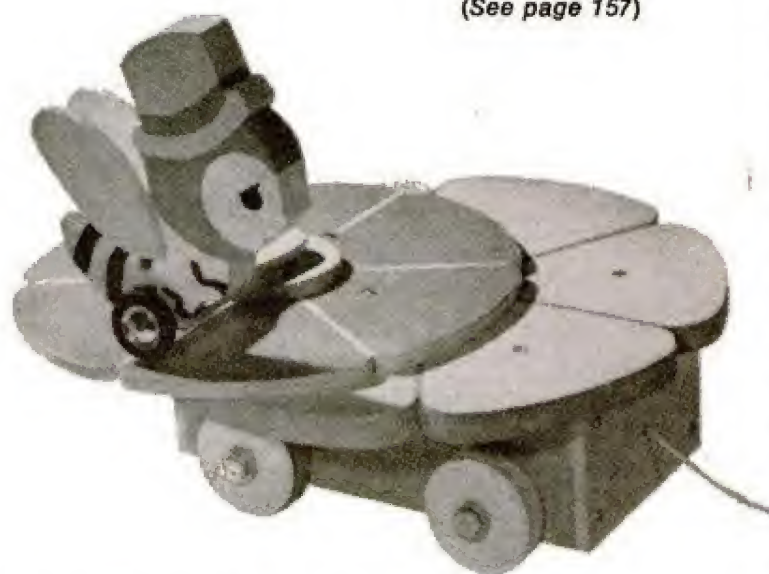
(See page 154)





## 5 Musical crèche

(See page 157)



## 6 Bumblebee pull toy

(See page 166)

# Six quick-and-easy projects

You'll have time to make them for Christmas if you start now.

Now is the time—before you're caught in the crush of last-minute Christmas shopping—to give serious thought to making some of the presents yourself. There are two good reasons for wanting to give a gift you have created with your own hands:

- You'll save money. An item of a quality comparable to any project shown here cannot be bought for what it will cost you to build.
- Your gifts will be treasured. A toy you make for your child will be, more likely than not, passed along to a grandchild.

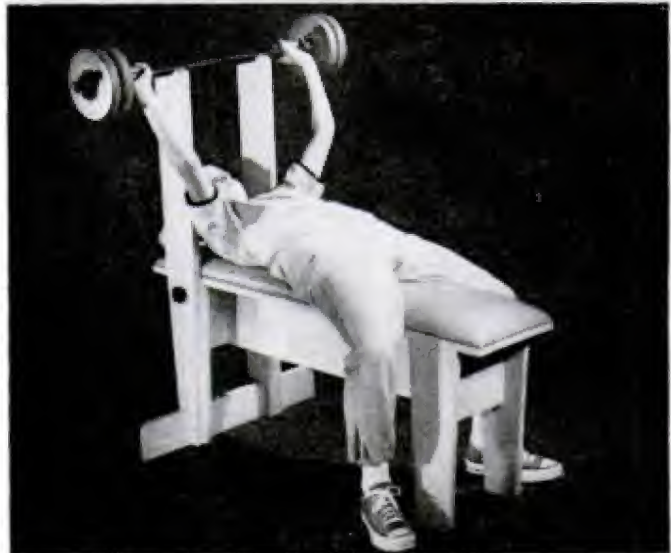
The projects are all relatively easy to make (although the level of woodworking sophistication varies slightly from one to another). The most difficult project shown is the shuffleboard table, but even this can be simplified, if desired, by using butt corners on the rails instead of the interlocking type shown on page 155. (It should be noted, however, that the latter is stronger.) And on the weight bench, for looks and practicality—resistance to scuffs and bumps from youngsters—we used Johns-Manville Melamite birch plastic laminate on all exposed parts. The cost could be lowered by painting or staining and varnishing. But the beauty of the laminate is that once it's done, there is no periodic refurbishing. However many projects you decide to build between now and Christmas, you're sure to find it a rewarding way to spend evenings over the next few weeks. To make it easy, complete plans for all projects follow.



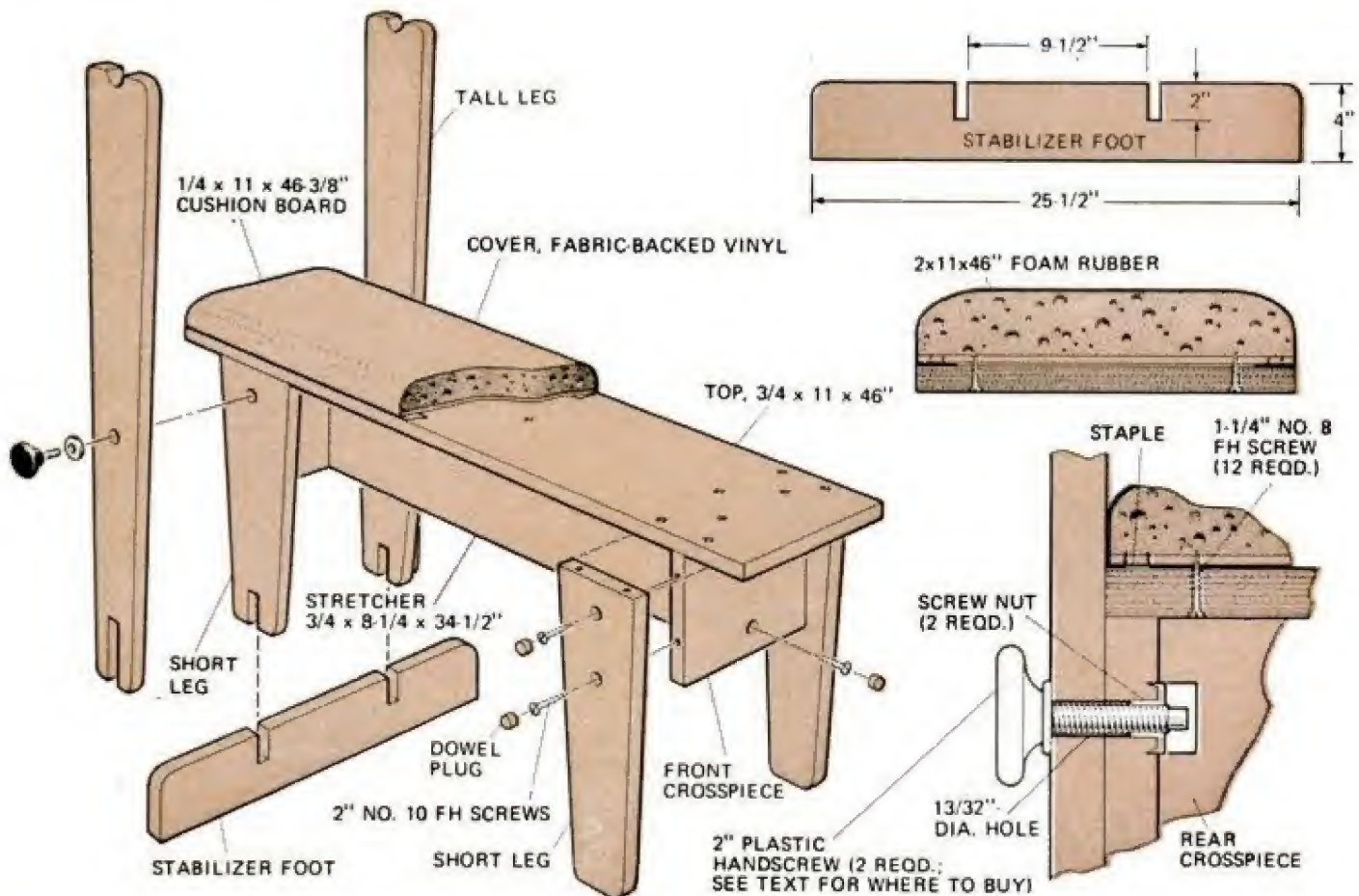
# 1 Weight bench

One of the best ways for an athlete to ready himself for an upcoming sports season is to follow a daily program using a weight bench and barbell. The bench shown is based on a design by high-school teacher and coach Jack Fisher of Newark, N. J. The stabilizer foot at the head end of the bench makes it as rigid as expensive commercial benches you'll find in sporting-goods stores.

The original bench was made entirely of  $\frac{3}{4}$ -in. fir plywood and covered with plastic laminate for durability and looks. This step, of course, is not necessary, but since little laminate is required, is worth considering. All four short legs are alike except that only two are notched; the two tall legs are identical. A handscrew turned into a tee nut embedded in each rear short leg is used to attach the tall legs to the bench and makes it simple to remove them when desired. Both crosspieces are the same size, but you'll notice that the rear one is notched to provide clearance for the threaded hand-screws. If you have difficulty obtaining the 2-inch-thick cushion foam and handscrews,



**Weight bench** can be used to develop tricep and bicep muscles. For correct bench use, see facing page.







Nails are used to assemble bench temporarily, but for strength and rigidity, finish with screws and glue.



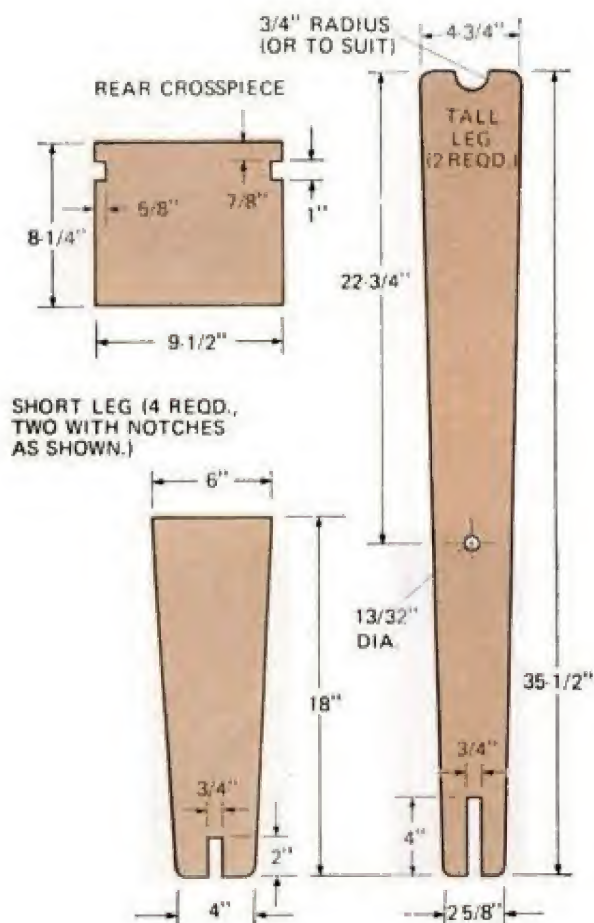
Notched stabilizer foot should have a snug fit with mating notches on two short, nonadjustable legs.



Screwheads are plugged if bench is to be stained or painted. For laminated bench, simply fill and sand.



After boring  $\frac{1}{2}$ -in. clearance hole, tee nut for hand screw is driven home with a couple of hammer blows.



Armor Co., Box 290, Deer Park, N. Y. 11729, will supply the cushion for \$2 and the handscrew set for \$4.50, both postpaid.

If working with plastic laminate is a new experience for you, refer to *How to Work With Plastic Laminate* (page 154, March '70 PM).

Once the bench is built, it is important that it be used properly. A quickie use-course is given below; serious students should consider buying a weight-lifting book.—*Harry Wicks and John Capotosto*

#### How to use a weight bench

1. Always stretch and loosen up before lifting.
2. Position: Lie on back, feet flat on floor with eyes directly under bar. Hands in wide position to work on chest (pectoralis); hands close to work on arms (strength).
3. Straighten arms to clear bar off support, then bring bar forward over chest. Lower bar to chest while inhaling. Raise bar to full extension while exhaling. Complete desired number of repetitions and replace bar on the support.

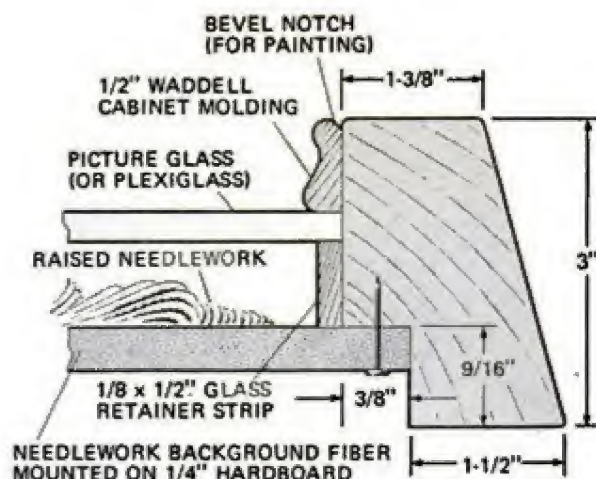
*In general.* Weight to use depends upon individual strength; use weight that is heavy for you (one you can't lift more than 10 times). For strength, increase weight as your strength increases. For endurance, use weight you can lift 15 to 20 times each session.



## 2 Deep needlework frame

Though some needlework can be considered two-dimensional because the surface design is made up of thread and there is no appreciable depth, many pieces are really three-dimensional with deeply piled flowers and figures. The latter cannot be framed with an ordinary picture frame unless the picture glass is removed. This, of course, is undesirable because the piece is then exposed to dust, fingers and other possible sources of damage which will shorten its life.

The custom frame shown at right solves this problem and adds to the visual effect of the hanging. The design permits use of ready-made hardwood molding; this simplifies the project considerably. The cross section shown will accommodate a workpiece of  $\frac{1}{2}$ -in. thickness. If yours is deeper, sim-



ply increase the dimension of the shoulder. Rip the outside bevel cut on four lengths of stock, then clear out the rabbet. Glue the molding to the individual strips before mitering the corners. Assemble frame with white glue and finishing nails.

—Rosario Capotosto

## 3 Shuffleboard table

Here's a gift the whole family can enjoy—a table shuffleboard. The waxed bed is of solid-core birch plywood with the scoring zones inlaid with strips of  $\frac{1}{8}$  x  $\frac{1}{8}$ -in. walnut. The grooves for the inlays are saw kerfs made on the bench saw.

The 1x3 birch rails have interlocking joints at the corners. To make such joints, you first groove the end rails to the depth shown. Then you cut the  $\frac{1}{8}$ -in. slot and tab with one cut at right angles to the groove. To make the side rails, after cutting a  $\frac{1}{8}$ -in. notch in the end of the rail as shown, you turn the rail over and make a second cut to create a  $\frac{1}{8}$ -in. tab. Finally, a  $\frac{1}{8}$ -in. slot is made to the depth shown.

The 12 weighted pucks are mass-produced from  $\frac{5}{8}$ -in.-thick wood in the following manner. First the wood is clamped to the drill-press table and a  $\frac{3}{4}$ -in. hole is bored completely through the wood. Then, without unclamping the work, the  $\frac{3}{4}$ -in. bit is replaced with a hole saw and a 2-in. plug is cut completely through the wood. This produces a doughnut shape. Next a same-size Formica disc is cut with the hole saw and cemented to the bottom of the puck. Now the outer edge of the puck is smoothed by



Game can be played by two, three or four persons. For game rules, see instructions on opposite page.



Shuffleboard weights (pucks) are stored in hinged rack beneath table. Each rack will hold six weights.



A hole saw is also used to form the storage wells for the pucks. First 2-in. holes are bored completely through the  $\frac{3}{4}$ -in. thickness. Then  $\frac{1}{8}$ -in. tempered hardboard is glued to the underside and 1-in. finger holes are bored in the center of the 2-in. holes.



## 4 Wall-mounted message center

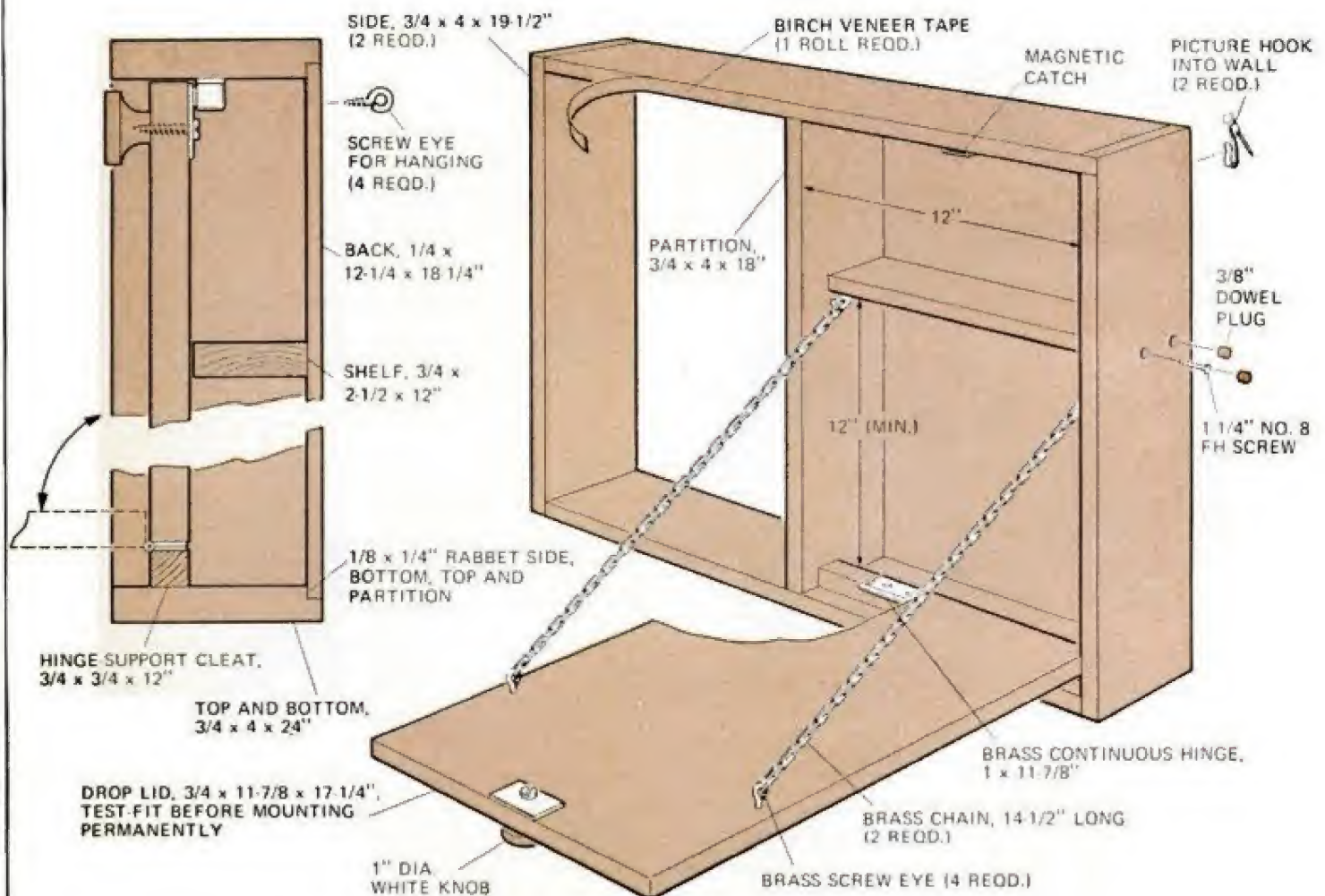
This efficient, neat-looking message center will be welcome in any active household. Simplicity of design makes it particularly easy to build, although the finished piece has the look of painstaking craftsmanship. The unit provides an on-the-spot place for recording telephone messages before they can be forgotten, a telephone surround that gives the center a built-in custom look and a place behind the bulletin board for convenient storage of pencils, pads, Yellow Page directory and the like. When the board is flipped down, two brass chains hold it so you can use it as a table while using the directory.

The center shown was constructed of  $\frac{3}{4}$ -in. cabinet-grade birch plywood, but if preferred, the unit can be made up using a solid soft or hard wood. If you do use plywood, remember to order a roll of matching flexible wood tape for concealing all exposed plywood edges. To finish the piece, apply



Center surrounds wall telephone, provides convenient chalkboard for messages and directory storage.

stain and allow to dry overnight. When dry, apply several coats of stain-finish varnish, sanding between coats. Use chalkboard paint on the bulletin board.—Gary Gerber





# 5 Musical crèche

Marching 'round and 'round to the accompaniment of a Christmas carol, three kings come "from the East" in search of the Christ Child who, with Mary and Joseph, occupies the second tier of this musical crèche. On the top tier are a shepherd and sheep. This model crèche is a handsome decoration for a mantel, or perfect for a centerpiece setting when surrounded with boughs of evergreen. It's a good project even for those who feel that carving is beyond their skills as commercial figures of all types are available that will work just as well as the handcarved ones. But if you want to try your hand at "whittling," front and profile views shown will give you a head start on the carving.

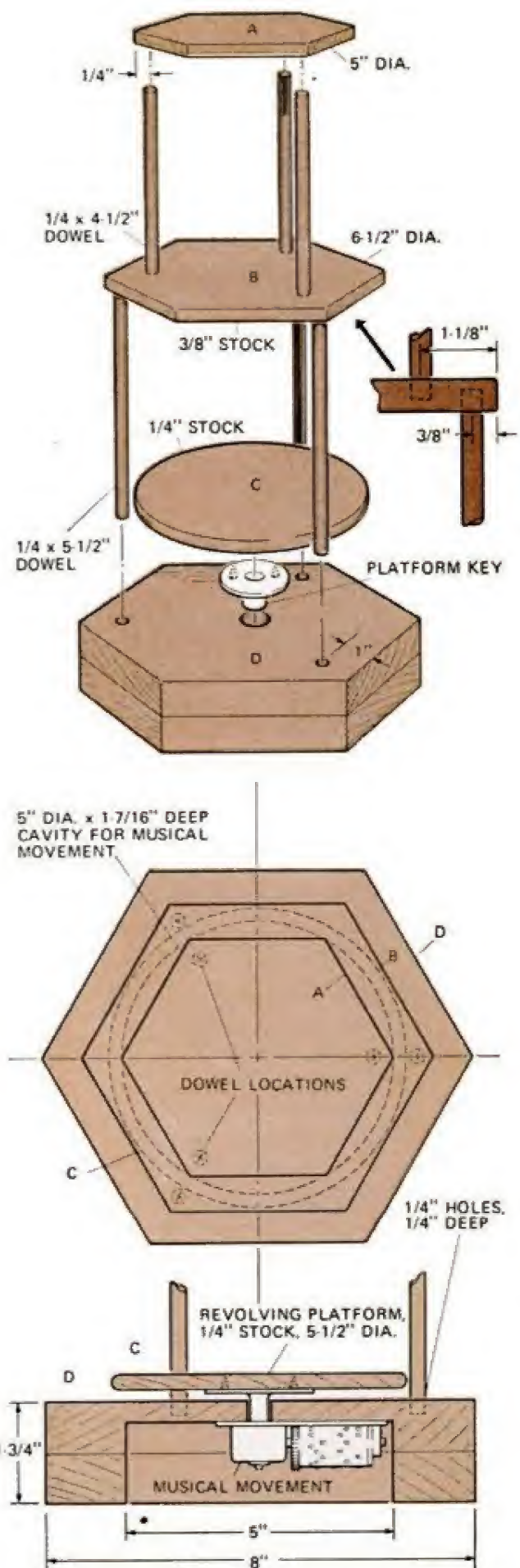
For this crèche,  $\frac{7}{8}$ -in.-thick birch was used for the platforms. To make the base, glue and clamp two thicknesses to create a  $1\frac{3}{4}$ -in.-thick block. Lay out an 8-in. circle and divide the circumference into six equal



Platform B is centered on base. Dowel centers are used to mark locations for boring dowel holes.



Movement was purchased from Walters Modern Hobby Shop, 207 French Rd., Utica, N.Y. 13502. Cost: \$4.50.





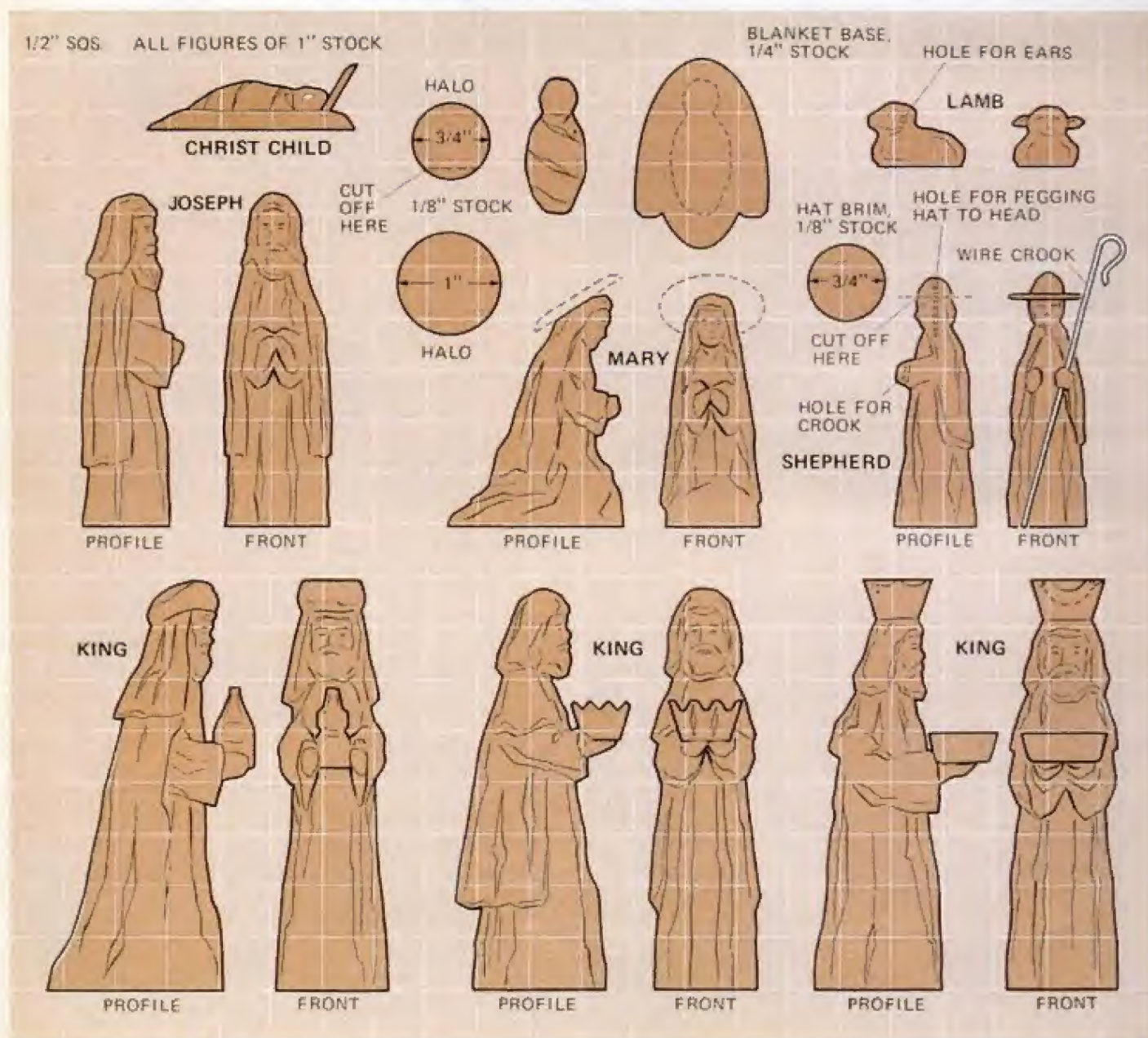
parts to create the hexagon. After cutting out the hexagon, mount the block on your lathe faceplate and turn out the cavity shell to accommodate the platform winding key. Sand the base smooth.

Cut and sand the other two hexagons using  $\frac{3}{4}$ -in.-thick birch. Bore  $\frac{1}{4}$ -in.-dia. holes  $\frac{1}{4}$  in. deep into the top side of the base platform as shown. Place dowel centers into holes and mark the locations for the underside of platform B for  $\frac{1}{4}$ -in.-deep blind holes for the dowel top ends. Repeat the procedure to locate dowel centers exactly between platforms A and B. With tier assembled, fasten the musical movement in place with screws. The revolving platform for the kings is turned from  $\frac{1}{4}$ -in. stock. The rest of the project is the carving of the figures. These can be left natural, varnished, or if you have the skill, realistically painted.—Elma and Willard Waltner

(Please turn to page 166)



Countersink chucked in a drill press works well for drilling out the top of one king's crown.





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# Build your own VW-powered



The last word in simple construction, this mini aerobatic sport plane can be completed in as little as six months. You can even buy the parts in kit form to speed the job.

by Sheldon M. Gallager  
and Howard Levy

PHOTOS BY HOWARD LEVY

Ever since Harris "Woody" Woods designed a strange-looking craft called the "Rail," he's been intrigued with the idea of single-beam construction for airplanes. The Rail was just what its name implies—a long stick with wings, tail, two engines and a seat for the pilot stuck on. It was breezy and primitive, but proved so simple to build and fly it became an instant favorite of many beginning pilot-builders.

Now Woody has applied the same basic rail principle to a full-fuselage configuration and the result is the Scamp—a scrappy little low-cost, single-seater, open-cockpit, all-metal biplane that brings the exciting world of sport flying to virtually anyone with ordinary home-shop tools and skills. Powered by a VW engine, it offers simplicity of construction for the first-time builder and safe, easy handling for the low-time flier. At the same time, it's hot enough to supply the thrills sought by more advanced pilots. Stressed for 6 Gs positive and 3 Gs negative, it's capable of most aerobatic maneuvers except snap rolls.

Like the Rail, the Scamp is built around a 2x5-inch extruded box beam that runs the full length of the airframe. This forms the plane's backbone, like the keel of a ship. Wings, tail, fuselage bulkheads, landing gear and all other major structural members are anchored to the beam. A second beam or "mast" extends vertically to support the upper wing. It's this combination of central

rail and mast that gives the Scamp its tremendous strength. It also acts as an automatic alignment guide, eliminating the need for jigs normally required for proper positioning of fuselage parts.

The Scamp is the crowning point in a long career of impressive achievements by Woody. A design engineer for such well-known aircraft companies as Piasecki, McDonnell, North American, Lockheed and Bell, he's turned out more than a dozen homebuilts in the past decade—all highly successful. By special arrangement, his plans for the Scamp are being made available to PM readers. As an additional aid to the home builder, Woody will also supply parts for the Scamp in complete or partial kit form. With the help of these, it's possible to build the ship in as little as six months for less than what most people spend on a family car. For those who prefer closed-cockpit comfort, a single-wing cabin version, called the Quail, is also available.

The rail is not the only innovation Woody has brought to his homebuilts. In the Scamp, the ailerons are in the upper instead of lower wing—unusual in biplanes. This gets them up into "clean air," away from propwash turbulence, for better control. The same is true of the high-mounted "T-tail," which improves spin and stall control. Wing spars are stock metal tubes for high

(See drawing on following page,  
[text continues on page 164](#))



# biplane from PM plans



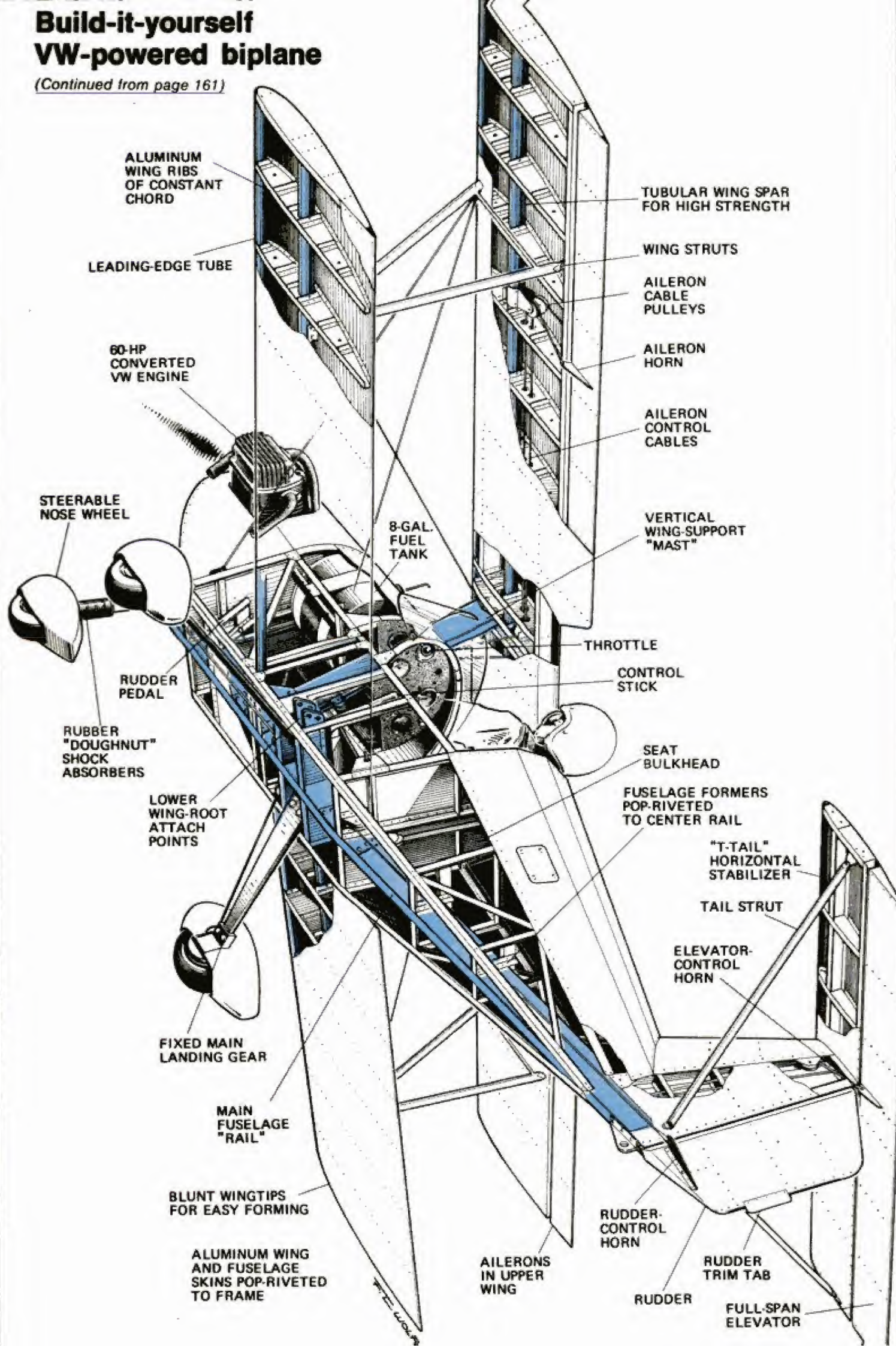
**Pair of flying midgets:** Above, high-wing, enclosed-cockpit Quail; below, biwing, open-cockpit Scamp. Basically similar in construction, both are powered by VW engines, can be built from either plans or kits. Scamp is high-performance ship stressed for most aerobatic maneuvers.





# Build-it-yourself VW-powered biplane

(Continued from page 161)





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## BUILD YOUR OWN VW-POWERED BIPLANE FROM PM PLANS

(Continued from page 160)



**High-mounted T-tail** (left above) improves stability, permits full-span elevator for ease of construction and good control. Rudder trim tab is simply small metal strip hand-bent to proper trim. Cockpit view (cen-

ter) shows portion of "mast" protruding up behind instrument panel to support upper wing. Unusually wide offset wing stagger (right) gives easy access to cockpit, also good ground visibility ahead of lower wing.

strength and easy fabrication. Rolling the sheet-metal wing skins around tubes at the front produces neat, smoothly rounded leading edges—a clever dodge. All skins and most frame members are simply Pop-riveted in place. Fuselage contours avoid tricky compound bends, yet provide a trim, sporty look.

The Scamp uses a fixed tri-gear with steerable nose wheel. Recommended engines are VWs in the 1600-1800-2100-cc range. The prototype is powered by an 1834-cc developing about 60 hp. Performance and weight vary somewhat with engine choice, but cruising speeds are typically 90 to 95 mph, with a top of 125 mph. Stall speed is a tame 42 mph, making the Scamp a ship you can fly in and out of pasture strips. Rate of

climb is 650 to 900 feet per minute; range, 250 miles on an eight-gallon fuel supply. Overall length is 14 feet; wingspan, 17½ feet.

Plans for the Scamp are \$49.98 (see instructions for ordering below). Parts are available directly from Woody at Aerosport, Inc., Box 278, Holly Springs, N.C. 27540. The complete construction kit, less engine, sells for \$2245. Partial kits—there are six—range from \$280 for the landing gear assembly to \$550 for fuselage bulkheads and skins. Plans and kits for the Quail are also available from Aerosport. Woody does not supply VW engines himself, but warns it is *absolutely essential* that they be properly converted for aircraft use. Some VW-powered planes have failed, he points out, because their builders attempted to use the engine as it came right from the car—a highly dangerous practice. Reliable VW conversions can be obtained from outfits like Barker and Revmaster for \$700 to \$1400. ★ ★ ★



**Blunt nose cowling** is cleverly shaped to give pleasing appearance without requiring tricky compound curves. Engine heads are exposed—also for simplicity.





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## SIX QUICK-AND-EASY PROJECTS

(Continued from page 158)

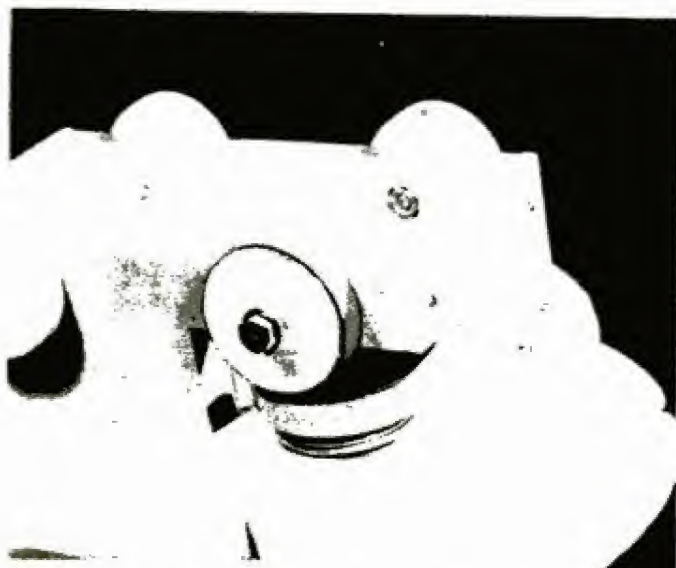
### 6 Bumblebee pull toy

As this toy is pulled along by a youngster, the smiling bee "buzzes" around the petal continuously, "alighting" only when the pulling stops. While sure to delight toddlers, this pull toy will make parents happy as well because the "buzzing" is silent—no clacking or quacking to annoy parents.

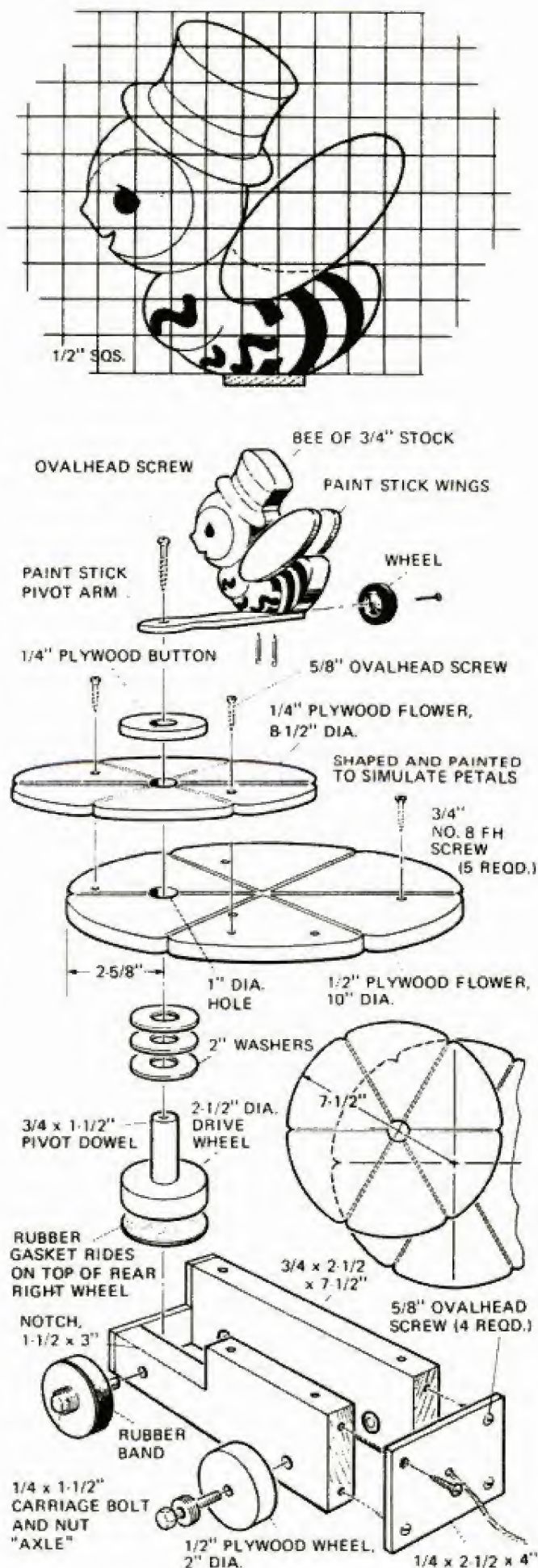
As can be seen in the drawing at right, the toy is far easier to make than one would suppose when watching the finished toy in action. Parts are easy to make and assemble; no sophisticated tools, techniques or knowledge are called for in the making. In fact, the project can be completed entirely with handtools using a coping saw for shaping petals and bee, brace and bit for all necessary boring. The rest of the job calls for gluing, sawing, nailing and finish-painting with nontoxic paint.

The wheels on the toy shown were cut from 1/2-in.-thick plywood. If you lack a jigsaw or holesaw—either of which must be used to cut perfect circles—buy a length of 2-in.-dia. hardwood dowel, and cut off 1/2-in.-thick pieces like slices of bologna.

It is best to tack-assemble the toy before finishing to assure that moving parts work as they should. When satisfied, disassemble the piece, do the finish painting and permanently assemble.—*Merton H. Slutz*



Upside-down view shows what makes bee buzz—rubber gasket on drive wheel rides atop right rear wheel.







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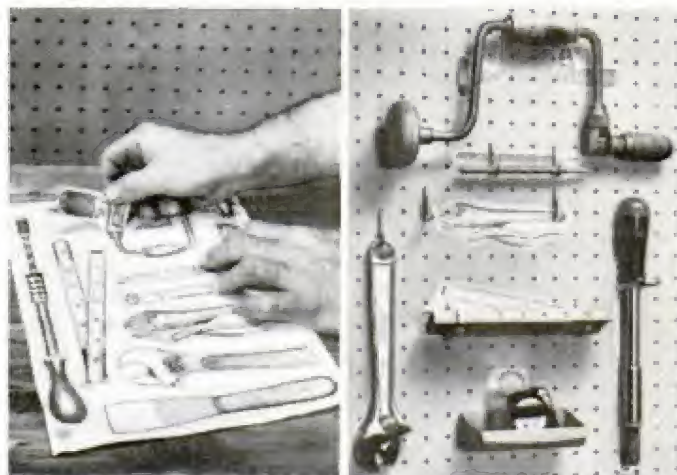
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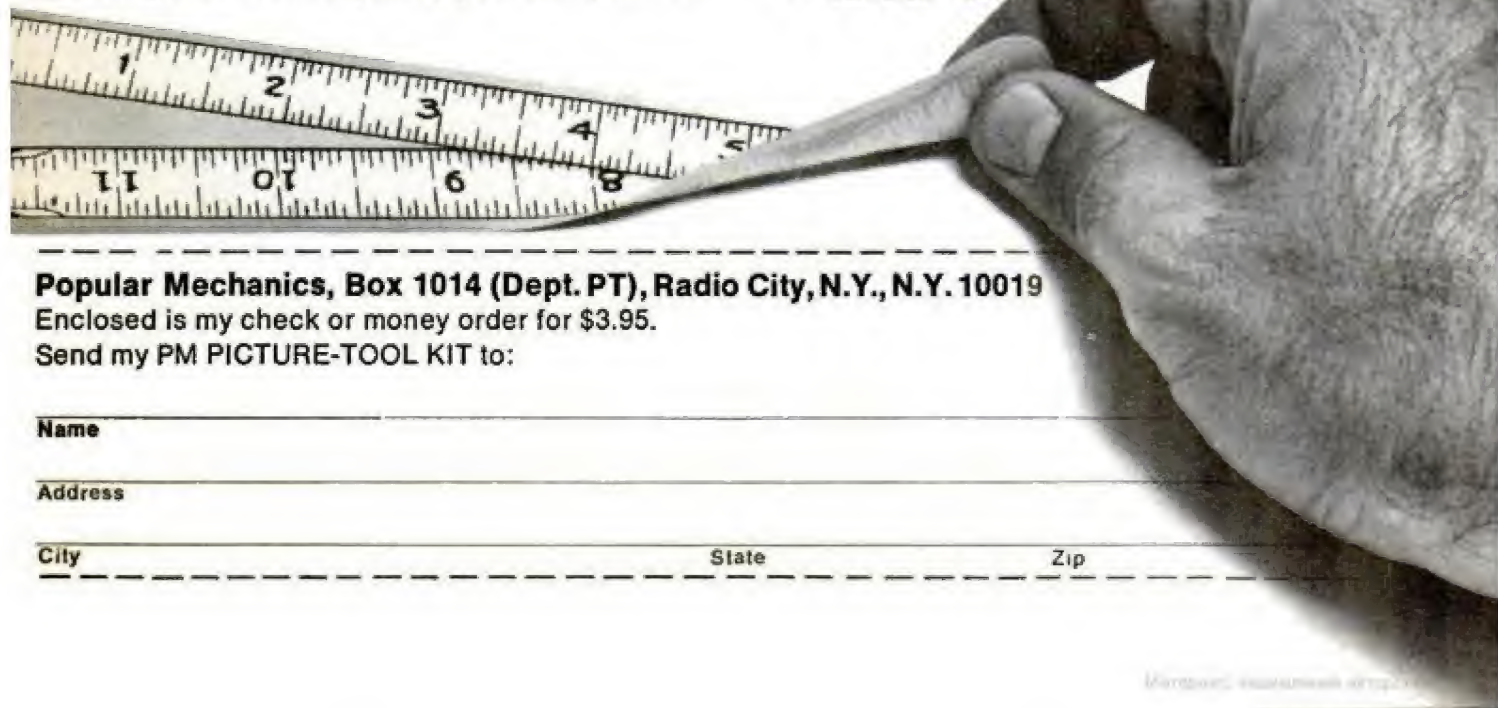
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# Hobby kits for fun at Christmas



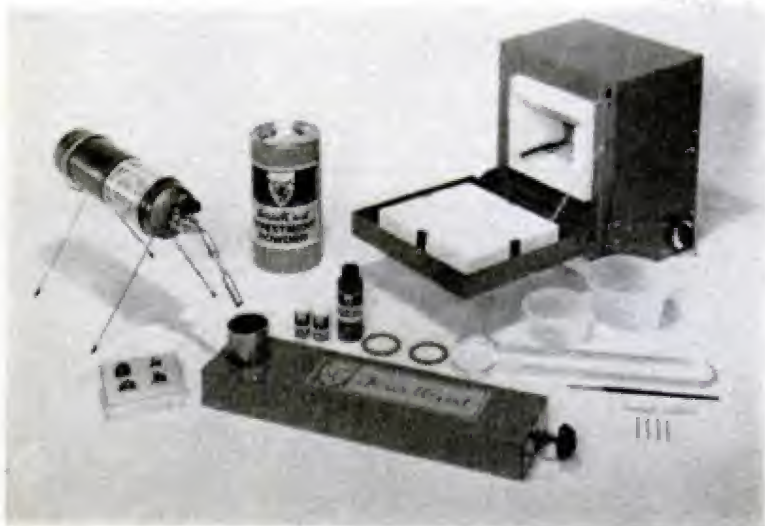
## Shaker Maker switchables

The Flintstones and Buggles join the rest of the hairy bunch of people, picture, animal and bird sets by Ideal Toy Corp. Without electricity, heat or hot water, youngsters can cast an endless number of miniature figures with interchangeable molds having three front pieces and a back. Thus a cowboy can be cast with a monkeys' body and a woman's feet, or 27 other variations. The Flintstones include Fred, Wilma and Dino; the Buggles are wiggly bugs, with elastic cord. About \$6.



## Flower-shaped candlemaker

A new special wax lets you make delicate flower leaves and petals without heat with Skilcraft's Candle Maker kit. Combining regular wax for bases and flexible wax for petals, the kit contains 2 lbs. of flexible wax in slab form, 1 lb. regular wax, 8 chips of nontoxic colors, melting pot, petal and leaf-pattern sheet, 3 candle center/base molds, aluminum-foil tray, 6 ft. of wicking material, gold glitter, wax-cutting tool, floral scent and full instructions. About \$8, in department-store toy centers.



## Precious-metal casting kit

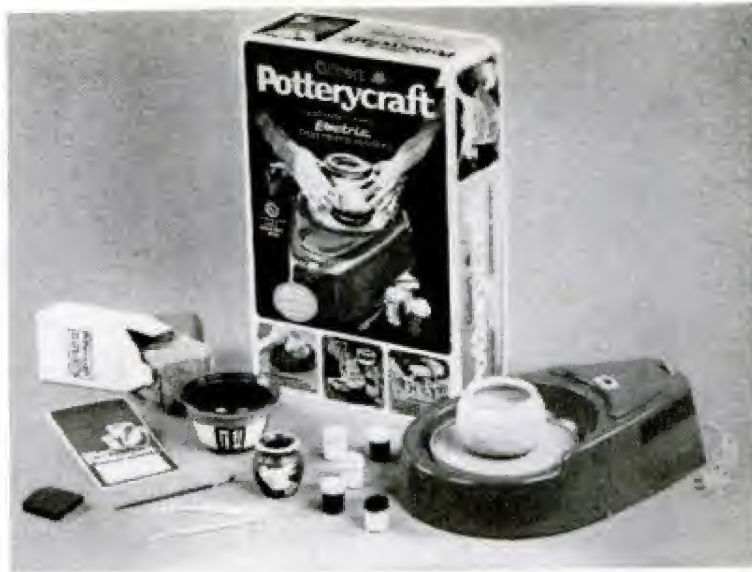
Employing the lost-wax process, you can make beautiful professional-quality jewelry with Jewel-Cast kit from Classic Industries, Culver City, Calif. 90230. Complete instructions take you through the five basic steps: attaching sprue, investing, burn-out, casting and polishing. Kit includes vacuum caster, kiln, jeweler's torch, tongs, mixing bowls, debubblizer, casting powder, flasks, special alloy metal, sprue wax, sticky wax for attaching sprues and four wax patterns. It sells for \$99.50.



# .. and the rest of the year

## Handcrafted ceramics kit

Using clay which air-dries, no baking or firing is required to make hand-thrown ashtrays, candlesticks, vases, bowls, flowerpots and other ceramic pieces with Gilbert Industries' Potterycraft. An electric, benchtop potter's wheel features variable-speed drive: fast for throwing or slow for decorating. Kit also contains nontoxic glaze and water-soluble paints, shaping tools, artist's brush, potter's sponge, 3 lbs. of air-dry clay and a step-by-step instruction booklet. Price about \$30.



## Aeronautics lab kit

With this kit, your youngsters can study the history of flight, learn about aerodynamics, experiment with the nature of flight and propulsion, construct a helium balloon, aileron-controlled glider, rocket with automatic parachute recovery and others. Kit contains all parts for making over 100 experiments in a 159-page manual and it also includes a free membership in the Logix Science Club. It's \$15.95 postpaid from Edmund Scientific Co., Edscorp Building, Barrington, N.J. 08007.



## Moby Dick scrimshaw kit

Widely regarded as America's most authentic folk art, scrimshaw is the carving of a design on whale's teeth and bone that was practiced by men who sailed whaling ships in the 1800s. While the Moby Dick scrimshaw kit does not include real whale ivory, it provides a three-piece polystyrene form which, assembled, simulates a 7-in. whale's tooth. Kit has everything needed to etch and antique the tooth. Made by Whiting, a division of Milton Bradley Co.; under \$7 at hobby/toy stores.





# World's first solar-powered watch

This fascinating quartz watch runs virtually forever, even has a calendar good for the next 126 years.

by Stephen Walton

**Silicon solar cells** on top give watch cobra-like look. Light-emitting diodes on edge facing the wearer display time, date, seconds count. Dots between numerals are binary code for year in leap-year cycle.

Quartz watches are almost commonplace by now, but this one has plenty of new features that make it special:

- It draws its power from the sun (or ambient room light), using silicon solar cells like Skylab's to keep nickel-cadmium batteries charged.

- It incorporates a true calendar—not just a day-counting mechanism—that keeps track of the number of days in the month and allows for leap years as well. It won't need resetting until the year 2100.

- It has a digital display of light-emitting diodes and automatically adjusts the display's brightness to the light it's viewed in—it's claimed to be the first LED watch display visible in full sunlight.

- Its working parts are sealed into a module that can stand 5000-G shocks and boiling and freezing temperatures. Neither the watch module nor its case includes a single threaded fastener.

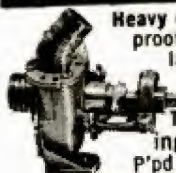
Heart of the watch is a quartz crystal vibrating at 32,768 Hz. This frequency is

*(Please turn to page 174)*





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## SOLAR-POWERED WATCH

(Continued from page 172)

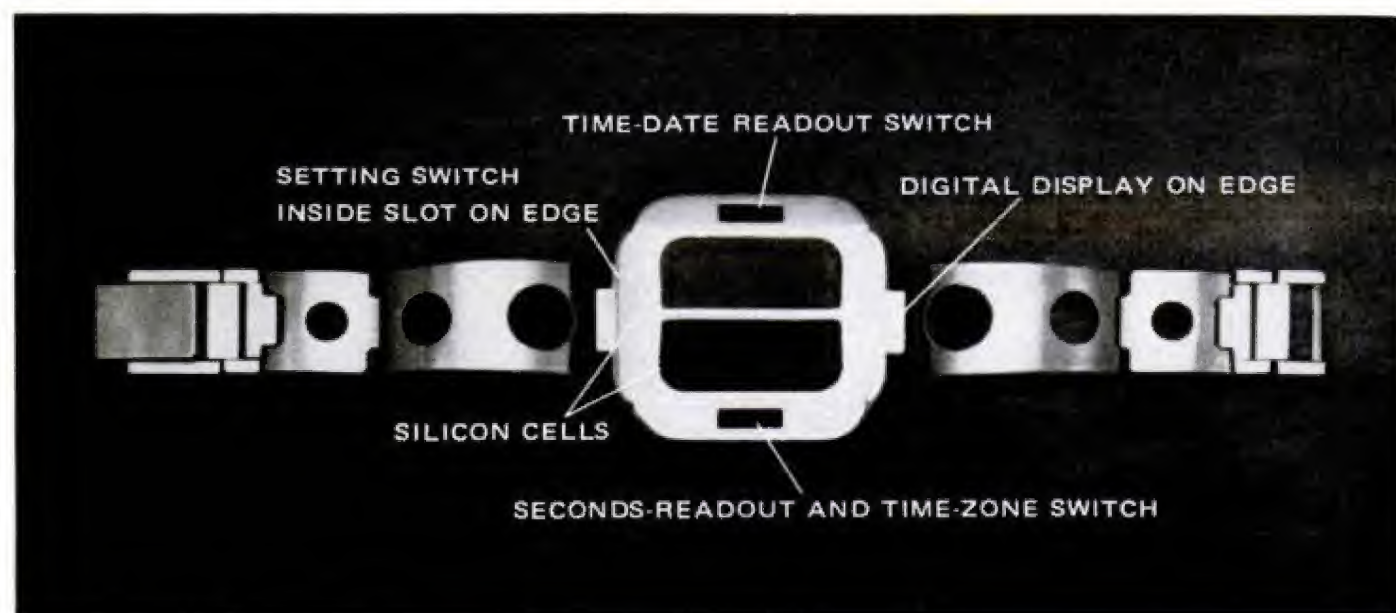
turned into time and date-keeping information by a complementary MOS (metal-oxide semiconductor) integrated circuit with more than 4 trillion different logic states. According to the watch's inventor, Roger Riehl of Troy, Ohio, the circuit is a breakthrough in the number of components used—about 1100—to achieve its functions. An equivalent circuit would require about 4500 transistors. Timekeeping accuracy within a minute a year is claimed.

Wearing the watch, you don't have to roll up your sleeve and go outdoors once a day. A total of 14 hours of sunlight takes the nicad batteries from dead to full charge, which will give six months of normal use. This amounts to an average of about 10 or 15 minutes' exposure a day, and the watch will also charge, although more slowly, in room light. Left in a drawer, with no drain from the LEDs, the watch will run for a year on a full battery

charge. Nickel-cadmium batteries have a limited life, however, and will have to be replaced—perhaps once a decade.

Replacing batteries will require opening the module into which all the watch's operating components are sealed. This is an injection-molded Lexan jacket filled with a jelled epoxy. Placed in a stainless-steel shroud, the module is held in the watch case by overrides on the pins that also attach the watchband. Tested to withstand pressures equivalent to 300 ft. of water, the watch was undamaged after being subjected to sustained temperatures of 180°F., being placed in boiling water and frozen into a block of ice.

In addition to three output brightness levels and a switch for setting time-zone changes without changing the calendar, the watch offers a choice of 12-hour or 24-hour time readout and carries a 3-year guarantee. The Synchronar solar wristwatch is made by Ness Time, 3780 Fabian Way, Palo Alto, Calif. 94303, and retails for \$500.



**Controls** have no electrical connection to sealed watch module. Slide "switches" on case move magnets that actuate reed switches inside module. To read the time, move upper switch (on right-hand side from wearer's point of view) toward display, away from display for date. Moving lower (left-hand) switch toward display starts count of seconds; moving it away (against a stronger spring) resets hour for time-zone change, but does not affect calendar. Setting switch is located inside slot to prevent accidental movement; when used (e.g., after crossing the international dateline) it can be operated with a toothpick or paper clip.





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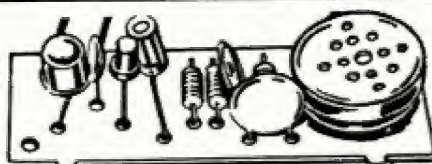


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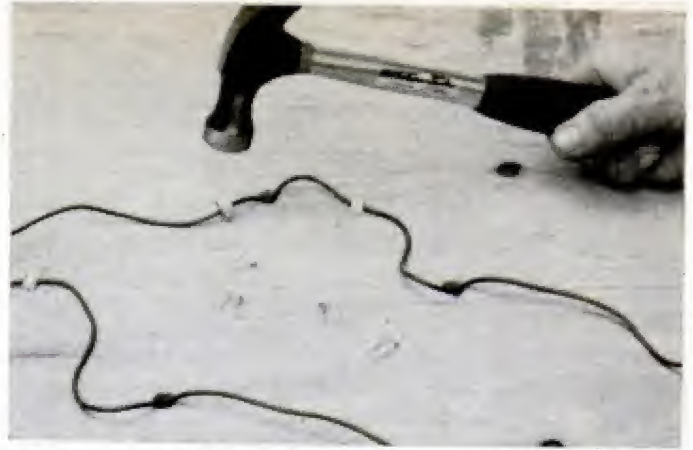




Front and back of tree are given two coats of latex enamel to improve looks, help waterproof the plywood.



The  $\frac{1}{2}$ -in. holes in bottom of cans are used as guide for drill when boring  $\frac{1}{2}$ -in. holes through plywood.



After outdoor light sockets have been inserted through holes from the back side, the socket wires are secured flat against the plywood with insulated staples.



Separate socket in top can (cut from old tree-light string) is fitted with short line cord and plug.

## YULE TREE—FROM TIN CANS

*(Continued from page 72)*

tree, built up from a single 4x8-ft. sheet. Three separate pieces are joined together from the back with 1x3 cleats and screws. Then two coats of forest-green latex enamel are rolled on the front of the plywood  
*(Please turn to page 182)*

Two 50-socket sets of miniature lights are required. The GE Merry Midgets are available in assorted colors and cost approximately \$6.50 per set.







## OF POPULAR MECHANICS

**Alaskan oil** will help ease the fuel shortage—but will the pipeline wreck the wilderness? Next month's cover story examines a bold engineering proposal that promises good ecology and oil, too. A 789-mile bridge would carry highway-rail traffic as well as the pipe 30 feet above the tundra and wildlife. . . . The wide, wonderful world of **motorcycle competition** offers something for everyone: dirt-track racing, friendly hill climbs, muddy struggles, hairy motocross events. . . . **Is airline safety slipping?** PM reviews some of the worst recent accidents. We go to the hangars to see what's done before the big jets take off.



We show you how to build five units of **modular furniture**—desk, bar, sewing center, dressing table and bookcase-room divider—in handsome modern and sharing a common construction technique. . . . First sign of spring for boatmen is a January boat show. We bring you **the best new boats for '74**, a preview of new models you'll see at shows and marinas this year. . . . Clip-and-

save know-how features include such familiar (or not so familiar) jobs as **How to Fix a Freezer**, **How to Hang Wallpaper**, **How to Work With Plastic Pipe**.

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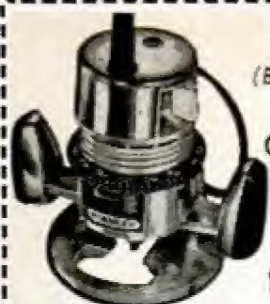
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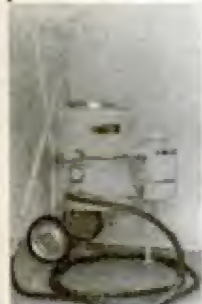
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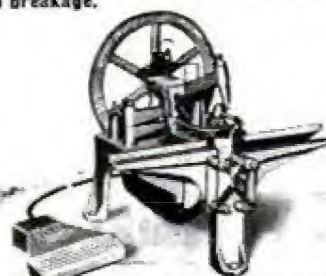


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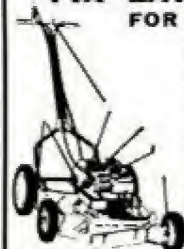
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## YULE TREE—FROM TIN CANS

(Continued from page 176)

tree and two coats of white (or green) are rolled on the back.

After all the cans are fastened to the plywood, 1/2-in. holes are drilled through the wood using the holes in the bottoms of the cans to center the drill.

Not all miniature tree lights can be used since some brands do not have enough wire between sockets to reach from hole to hole. (Be sure lights are rated for outdoor use.)

Two General Electric 50-light Merry Midget sets were used in the original tree, mixing red, green, blue and yellow bulbs and using red alone in the trunk cans. The bulbs and sockets are inserted in the cans through the holes in the back. Count off the 24th socket in the string and use it to start hole A in the vertical cleat. Work outward in each direction and upward. Do the same with the second string, inserting socket 24 in hole B and working downward. The two strings are plugged together and the wires stapled here and there to the plywood. A separate bulb and socket are used to top-out the tree since two 50-light sets leave one light short. This can be cut from an old regulation-size light string and plugged into the other light sets. Use a white bulb for the top one and center it in a star reflector cut from an aluminum-foil pizza pan.

Finally a 6-in. disc of common kitchen foil, with a hole in the center, is rubber-cemented to the bottom of each can. The shiny foil reflects light against sides of the cans to provide added sparkle. ★★★

## FOUR-WHEEL-DRIVING FUN IN WINTER

(Continued from page 105)

a channel that's deep enough to hang you up.

If hopelessly stuck, you should be prepared with your emergency kit to await rescue, usually a safer action in bad weather than walking out. This presumes you left word before you departed about where you'd be. You should always be carrying the clothing, implements and supplies necessary to keep warm, dry and fed, and to signal for aid.

If you're desperate, a spare tire full of gas laced with oil makes a dense and effective smoke signal.

Once you're out of the woods, off snowy highways and back home, clean your vehicle, so you'll be ready to go out again while all that fresh, white snow is packed in the mountains! ★★★

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(Continued on next page)



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(Continued from preceding page)

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(Continued from preceding page)

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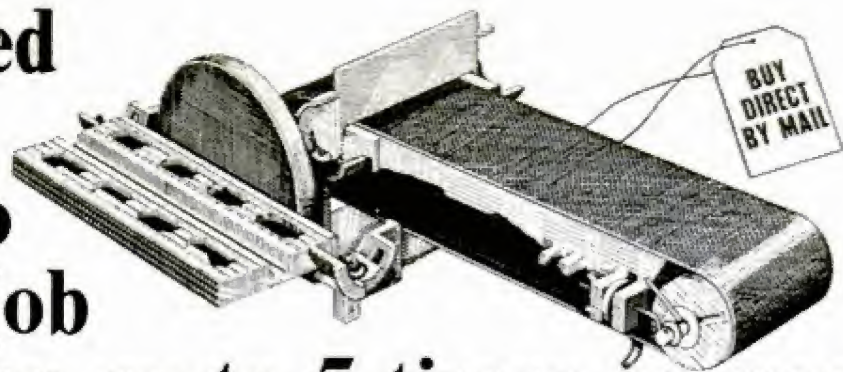
P-73

Mfg. of Saw Grinders—Distributor of Complete Saw Shop Equip. Box 2505 Terminal Annex, Spokane, Washington 99220 509-335-9811





# Unadorned power tools ...they do the same job as tools costing up to 5 times as much.



We skipped the chrome to save you money... but we did not skip anything on performance. Actually, we skipped more than just chrome, we cut out every costly frill that wasn't absolutely needed.

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## POWER SAW 8" tilt arbor saw ...crosscuts, rips,

mitres, cuts compound angles, dados, coves, moldings. Completely assembled with ground cast iron table, safety guard, splitter, mitre gauge. Less blade, motor. Rip fence for easier work alignment. \$3.50 add'l. Ball bearing model, \$5.00 add'l. Takes 1/2 h.p. motor or larger, standard blades, attachments. Wt. 26 lbs., f.o.b. factory



**\$19.95**



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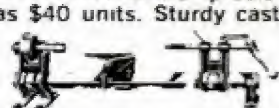
## BELT SANDER A precision unit. It changes from horizontal to vertical in seconds. Heavy, sander includes 4" x 36" sanding belt. Uses 1/2 h.p. or larger motor. V-pulley drive and multi-purpose drive spindle.



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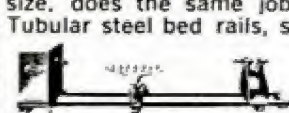
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## 3' WOOD LATHE ... 6" swing. Same precision and speed as \$40 units. Sturdy cast iron with tubular steel bed. Lever action tail stock, two-speed pulley, fits any motor. Set of 3 high speed turning chisels, \$5.95 add'l. 4" face plate, \$2.50 add'l. 15 lbs., f.o.b. factory



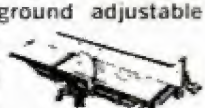
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## 4' WOOD LATHE ... 12" swing. Industrial size, does the same job as \$75 units. Tubular steel bed rails, screw action tail stock, three-speed pulley. Use any motor. 3 high speed turning chisels, \$5.95 add'l. 4" face plate, \$2.50 add'l. 30 lbs., f.o.b. factory



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## JOINTER-PLANER 4 1/8" x 22". Cast iron and steel, precision ground adjustable tables. For planing, joints, bevelling. Rabbets to 3/8" depth. Fence adjustable 0 to 50. Steel knives, dual guards. Use any motor. Precision ball bearing industrial model, \$10.00 add'l. Wt. 19 lbs., f.o.b. factory



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Please send me the units checked. Payment in full enclosed \$ or \$3 deposit each item enclosed, balance C.O.D. I must be fully satisfied or will return unit within 10 days for full refund. No questions asked.

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| <input type="checkbox"/> Ball Bearing Spindle at \$5.00   | <input type="checkbox"/> Opt. Hold Down Assembly at \$2.95     |
| <input type="checkbox"/> Belt Sander at \$19.95           | <input type="checkbox"/> 6" Swing 3' Lathe at \$14.95          |
| <input type="checkbox"/> Disc Sander Attachment at \$7.95 | <input type="checkbox"/> 12" Swing 4' Lathe at \$29.95         |
| <input type="checkbox"/> Mitre Gauge for Sander at \$1.95 | <input type="checkbox"/> Face Plate \$2.50 (either Lathe)      |
| <input type="checkbox"/> Drill Press at \$39.95           | <input type="checkbox"/> Turning Chisels \$5.95 (either Lathe) |
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